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Abbreviations

APM	Administered Price Mechanism
BIS 2000	Bureau of Indian Standards 2000
BCD	Basic Customs Duty
CIF	Cost-insurance and Freight
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Sulphur Dioxide
ETG	Expert technical Group
FOB	Free-on-board
HSD	High Speed Diesel
HC	Hydrocarbons
HCV	Heavy Commercial Vehicle
LCV	Light Commercial Vehicle
LNG	Liquefied Natural Gas
MBI	Market Based Instruments
MMBTU	Metric Million British Thermal Units
MMTPA	Metric Million Tonnes Per Annum
NGV	Natural Gas Vehicles
NO_x	Nitrogen Oxides
OECD	Organization for Economic Cooperation and Development
PM	Particulate Matter
SO_2	Sulphur Dioxide
USEPA	United States Environmental Protection Agency
ULSD	Ultra Low Sulphur Diesel
ULSP	Ultra Low Sulphur Petrol
VED	Vehicle Excise Duties
VAT	Value Added Tax

1

Introduction

Transport is a key infrastructure sector of the economy and plays a significant role in the overall development of the national economy. Improved transport systems are essential for accelerated economic growth. However, emissions from this sector account for a substantial and growing proportion of the total emissions loading in urban areas. In the National Capital Territory, for example, the share of vehicular emissions in total pollutants is over 65% (MoEF 1998). The impact of this emission loading on public health and the consequent health-care costs are enormous. Transport also has damaging effects on the global environment, related to build up of greenhouse gas emissions

To ensure the development of an environment friendly transport system, the environmental impacts of this sector have to be taken into account. For integrating economic and environmental sustainability, transport sector policies should signal the following:

- Most efficient use of available capacity of the transport sector
- Efficient choice of vehicles and fuels
- Efficient split of travel demand among various modes of transport
- Efficient infrastructure maintenance and management.

Need for incentives to promote environment friendly technologies

The mandated reduction in emission norms by governments has prompted vehicle and fuel manufacturers to constantly upgrade their products to meet the norms. This upgradation of technology in capital-intensive industries like the automobile and refinery sector would then translate into higher costs to consumers. Various governments internationally have hence played their part in bringing these technologies at affordable costs to consumers.

Almost all international effort to reduce pollution points to the fact that all emission reduction strategies succeed only when they are able to compete with the existing technologies in terms of their costs. Reducing the incremental cost of technology to the consumer by devising various incentives help in better penetration of these technologies before their mandated deadlines. There is also a need to avoid creating distortions in consumption patterns due to inefficient taxation of vehicles and fuels. In addition to the subsidies and exemptions that the government can give to these sectors to make consumers move to better technologies, a competitive environment is necessary to ensure that competition also drives manufacturers to change.

In light of the growing concerns regarding the environmental implications of the transport sector, an expert committee has been constituted to recommend an Auto Fuel Policy for India and devise a road map for its implementation. One of the key deliverables of this committee is to suggest fiscal measures to develop a sustainable transport system for the country.

Scope of the study

The scope of the study done by TERI is to provide inputs to the Automobile Fuel Policy to enable implementation of the roadmap for change in an efficient manner. The main outputs that were supposed to come out of this study are:

- Fiscal measures and concessions to automobile manufacturers to enable them to shift to Bharat Stage II and Stage III compatible vehicles.
- Tax structures of alternate fuels post APM
- Economic instruments for both vehicle and fuel producers to reward fast changes and penalise slow changes.

Study approach

The methodology followed in the study was a combination of literature surveys, interaction with experts, and interviews with agencies and organisations in this area, firstly to assess the quantum of investment in the sector, and secondly to evaluate the need and design of policy interventions. Thus the first step was to exhaustively review the international experience in promoting cleaner technologies to help in framing policies in this regard in the Indian context. Based on this, recommendations have been made on the initiatives necessary to facilitate the faster introduction of cleaner automobile technologies and fuels. Rationalising the various duty and tax structures for both fuels and vehicles being the industry demands for many years has also been studied and recommendations given for better penetration of these technologies. An attempt has also been made to gauge the effect on the revenues of the government in lieu of the incentives.

Structure of the report

The following chapter of the report identifies, and assesses the applicability of, economic instruments for pollution control in the transport sector. It also reviews the current use of market based instruments in the transport sector internationally and in India. Chapter 3 suggests strategies to promote the production and purchase of cleaner automobiles based on a review of the current industry structure and the various pollution control options. A similar exercise for the fuel industry is undertaken in Chapter 4

2

Economic instruments for mitigating transport emissions

It has been universally recognised that improved transport systems are essential for accelerated economic growth. Transportation in the urban context assumes even greater significance as large agglomerations are seen as the vertices of continued economic growth. The productive efficiency of urban agglomerations will be maintained only if mobility requirements in the cities are fully met. However, this productive efficiency in urban India is now threatened due to the increasing number of vehicles causing congestion, and thus slower speeds on roads. Obviously transportation infrastructure could be the primary bottleneck for the unimpeded growth of the country. Thus it is important that the existing transportation infrastructure is utilised optimally. This would imply that the pricing policies in the transport sector reflect not just the cost of providing mobility services, but also incorporate the externality costs and benefits that emerge from the transport sector.

This sector has become one of the major contributors to the total emission loading. This emission loading causes substantial health damage. Consequently the health-care costs are immense. In order to develop an environment friendly transport system, it is essential that the costs imposed by the transport sector on the environment be taken into account in the provisioning of transport services. This chapter analyses some market-based instruments for reducing vehicular pollution.

ansport and environment

The primary externality costs in the transport sector arise from the relationship between transport and emissions via the use of fossil fuels as the primary and overwhelming source of energy. Combustion of any fossil fuel in a motor vehicle results in a range of local pollutants being emitted into the environment, namely emissions of CO, HC, NO_X, SO_2, CO_2 and PM. The total emissions that a vehicle emits in its lifetime in turn depend on its fuel efficiency and its age.

Over the years, there has been a substantial increase in the travel demand in urban India. However, the growth in supporting infrastructure has failed to keep up with the rapid rate of urbanisation. This situation is epitomised by the transport systems of the metropolitan cities of India. Delhi, for instance, has the largest number of registered vehicles in India, despite being the third largest metropolitan city in the country. The dominance of personalised modes of transport has been a characteristic feature of this growth. The share of registered buses, which cater to about 53% of the total passenger travel demand, has been a paltry 1%. Even the share of the intermediate public transport, three wheelers and taxis, as a percentage of total motor vehicles, has gone down from 4.3% in 1985 to 3.2% in 1998 (TERI 2000).

There has not been a commensurate increase in the road space in the city and the city faces significant traffic problems. The rapid increase in the vehicle traffic, especially personalised transport, inadequate public transport, the existing inefficient land use pattern, and the resultant travel pattern together lead to congestion on the roads which in turn lead to reduced vehicle speeds. This leads to increased fuel consumption, further adding to the emission loading. The problem is aggravated further by the poor fuel quality, the poor condition of the existing vehicle fleet. and inefficient vehicle technology Thus, due attention has to be given to the enormous costs imposed by the transport sector by way of emissions.

Pollution control in the transport sector

There are two basic approaches for reducing vehicular emissions: reducing emissions per vehicle kilometre travelled and reducing the total number of kilometres travelled. These strategies require active government interventions and aggressive measures. Theoretically, the first best solution for reducing vehicular emissions is an emission tax. However, such a tax is difficult to administer and monitor as is discussed later. A more practical strategy would be to use a mixed set of instruments, which are dictated by either command or control, and/or the market based principles. Some of the instruments that can be used for controlling vehicular pollution are listed in Table 2.1.

Table 2.1 Taxonomy of policy instruments for pollution control in the transport sector

	Command & Control	Market based
Vehicle	• Emission norms • Compulsory - – I&M programme – Use of low polluting vehicles – Scrap polluting vehicles	• Differential vehicle taxation • Tax allowance for new vehicles • Promote retrofit with cleaner fuels
Fuel	• Fuel economy standards • Phasing out of highly polluting fuels	• Fuel taxation • Dirtier fuel to be taxed higher • Remove fuel price distortions
Traffic	• Physical restraint of traffic • Grade separation • Priority to public transport • Restraint on vehicle use by - – Management measures – Engineering measures – Control measures	• Congestion charges • Parking charges • Subsidies for less polluting modes

The traditional policy for regulating emissions from the transport sector in India has been promulgating emission standards, which specify the permissible legal emissions of pollutants in the ambient air presumably based on a process for reaching those standards. The approach for improving air quality so as to bring it into conformance with the ambient standards involved a three-step process:

- Identifying control technologies
- Specifying permissible emission limits based on the technologies
- Mandating all activities to conform to these limits

Thus, command and control measures have dominated the environmental regulation in the transport sector. Greater emphasis has been laid on setting standards and promoting specific technologies by mandating their usage. Emission control strategies in this sector, however, do not employ market-based instruments (MBI) for pollution control.

Since command and control policies do not in any way provide dynamic incentives for technological innovation and diffusion, under the current regulatory structure, the abatement activity is necessarily more expensive and inefficient as incentives for cost minimising adjustments are absent. Thus there is considerable scope for improvement given the current state of emission control strategies in India. Also, considerable wisdom has been accumulated in the use of MBIs in South East Asia, USA and Europe. Within price-based MBIs, indirect instruments such as input-output taxes, differential tax rates, and user fees have been used extensively India can draw lessons from the experiences of such economies and improve the efficiency of pollution control strategies.

Economic instruments for emission control

Economic literature has traditionally viewed pollution as an external cost arising out of economic activity – the external cost being the cost of utilising the 'assimilative capacity of the environment' that is not included in the price of the activity (Tietenberg 1992). The policy intervention that has been advocated in such a situation is a 'pigouvian tax' that would internalise such external costs.

However, as mentioned above, there has been limited application of market based instruments in the design of pollution control strategies in most countries – governments have largely relied on command and control strategies to mandate emission limits and emission control technologies. This trend can be in part attributed to the lack of sufficient understanding of economic instruments in reducing pollution, as also the perceived larger transaction costs of economic instruments. The lack of recognition of traditional market based interventions in pollution control strategies has lead to the development of a number of alternative instruments such as subsidies for pollution control, deposits as presumptive taxation, tradable permits, etc. This development has also been facilitated by failure of existing policies in mitigating environmental impacts of economic activity. Also, it is increasingly being accepted that the use of market based instruments lead to lower abatement costs compared to command strategies. This is particularly important in economies where rapid economic growth is dependent on lower production costs.

This section discusses some of the common pollution control strategies identified in economic literature and their applicability in the transport sector, particularly the necessary framework that would minimise the transaction costs for each.

Emission charges

Emission charges address the pollution problem at its source, by putting a price on something that has been free and, therefore, overused. They are a kind of user fee whereby the users pay for services of environmental resources or it can be thought of as a kind of compensation fee for damages caused. The charges offer incentive to conserve environmental resources. Through emission charges, polluters are charged a fixed amount on every unit of effluent emitted. The polluters are free to choose how much emission they abate and how much they emit by paying applicable emission charges. Polluters abate if it is cheaper to abate than to pay the charge, but they pay the charge if it is more expensive to abate. Emission charges are equitable, as the same charge is applicable for each polluter. The extent of emission reduction achieved depends on the level of charge. The greater the charge, the greater the emission reduction.

In the case of intermediate industries, the burden of tax becomes important The distribution impacts depend on changes in price and quantity of outputs of taxed firms. If charges do not affect prices of outputs, the full tax burden falls on the owners of the firm. If charges increase prices of outputs, the tax burden partly falls on consumers too. The latter case is pertinent in case the polluting industry is not competitive, where it may be possible to pass on the entire the tax burden of emission charges to consumers. For instance, in the case of the heavy vehicle industry in India, with only two manufacturers, the near monopoly situation would result in almost the entire tax burden being passed on the vehicle purchasers.

One form of emission charges is emission subsidies provided as rewards for reducing emissions below a base level. Thus emission subsidies are negative emission charges. Just like emission charges, emission subsidies work as penalty to emission; one unit of effluent emitted is the foregone subsidy. Subsidies are similar to charges in terms of efficiency, cost effectiveness, enforceability, and also on incentive to innovation. However, emission subsidies provide perverse incentives to polluters to overstate or raise the base level. Also, as a subsidy increases profit in the polluting industry, it invites entry of new firms in the industry, thus increasing the total number of firms resulting in an increase in the total level of emissions, even though emission per firm would reduce. Finally, the government would need to find necessary fund to meet the subsidy obligation.

A Deposit Refund System is a combination of emission charges and subsidy. Certain goods are taxed at the time of purchase (in the form of a deposit) but subsidised at the time of return of the used goods (by refunding the deposit). Examples are car batteries in the US, lubricating oil (engine oil) in Germany, and cars in Norway and Sweden.

Advantages of emission charges

The main advantage of emission charges is their efficiency aspects: these charges would ensure, under appropriate conditions, the least cost method of achieving the target emission levels. If all economic units are subject to the same charge, they will adjust their emission rates so that the equimarginal rule (that is the incremental benefit from abatement is equal to the additional cost of abatement) is satisfied. Administrators do not have to know the individual abatement costs for this to happen. Thus the informational requirements in this case are conservative. A second advantage of emission charges is that they produce a strong incentive to innovate, to discover cheaper ways of reducing emissions. Finally, they provide a source of revenue for public authorities.

However, emission charges require effective monitoring. They cannot be enforced simply by checking to see if sources have installed certain types of pollution-control equipment. Point sources where emissions can be effectively measured are the likely candidates for pollution control via emissions charges. This effectively rules out regulating each vehicle in the country. From the point of view of policy makers, the apparent indirect character of emission charges may tend to work against their acceptance. Standards have the appearance of placing direct control on the thing that is at issue, namely emissions. Emission charges, on the other hand, place no direct restrictions on emissions but rely on the self-interested behaviour of firms to adjust their own emission rates in response to the tax. This may make some policymakers uneasy because firms apparently are still allowed to control their own emission rates.

Application in the transport sector

Forms of emission charges are widely applied in the transport sector across the world. Some of these are listed below:

- Vehicle taxes based on emissions: this is a charge on emissions requiring vehicles, which have higher emissions to pay higher taxes.
- Price differential between leaded and unleaded gasoline or ultra low sulphur diesel and ordinary diesel: better quality fuel is priced lower, hence this taxes the dirty fuel, which is more polluting.
- Annual road tax differentiated by vintage: this taxes older and more polluting vehicles higher than newer vehicles.
- Higher tax on diesel cars and non catalytic converter converter cars: this is a kind of emission charge that taxes more polluting vehicles.

Tradable permits

Tradable Permits are a regime that define property rights for pollution by setting a limit on the total allowable emissions, and then allocating these across all polluters. The polluters are then permitted to trade in these emission limits and the price that would emerge in such a market would indicate the opportunity cost of incremental emissions to the polluters. Cost minimising behaviour would then result in efficient outcome.

Types of tradable permits

The literature on tradable classifies tradable permits into two distinct groups – emissions based and ambient based. In the former, polluters are allowed a fixed emission limit for each pollutant. Here it is necessary for the environmental authorities to define emission limits for each polluter based on the ambient quality desired at a number of locations and the abatement costs. In the case of ambient based permits, the environmental authority only allows a fixed deterioration in ambient quality at a number of locations and polluters have to trade with each other to obtain 'pollution rights' at each location. This implies, that the polluters need to obtain a portfolio of ' pollution rights' at the various locations, thus increasing their transaction costs. The pollution offset system is a hybrid of these two systems and allows for trades in emission permits only if these do not lead to higher pollution in aggregate. Thus the system allows for varying implications of emissions from different sources on environmental quality while ensuring that the transaction costs of polluters are minimised.

Advantages of tradable permits

Tradable permits are particularly useful if there is uncertainty in the technology that could be used for emission control. In such a scenario, an emission fee based approach may lead to a sub–optimal outcome, particularly when environmental authorities are unclear regarding the costs of emission control Since tradable permits mandate an environmental standard instead of an instrument to achieve the standard, the final outcome is assured. Also, while emission fees would have to be continuously adjusted for inflation, etc., such corrections are not necessary in a tradable permit regime, as the price of the permit is market determined. Thirdly, emission charges would necessarily imply additional costs on the polluters in terms of larger taxes, over and above investments in emission control technologies. In the case of tradable permits, on the other hand, if the initial distribution of 'pollution permits' is free, the incremental cost of pollution control is only investments in technology. Finally, tradable permits allow for a spatial variation in pollution levels that may be more politically and socially feasible compared to variation in emission charges.

Nevertheless, tradable permits would necessarily imply larger transaction costs on part of the polluters in the event that the initial distribution of permits is not the least cost solution. The incentive exists for polluters whose abatement costs are higher than the price of permits to buy these permits and vice versa.

But there may be significant search costs that may impede the transfer of such entitlements.

Application in the transport sector

The most obvious contenders for bearing the cost of emissions from the transport sector are the manufacturers and the users. Given that there are about 35 million vehicles registered in the country, a tradable permits regime for automobile users would imply substantial transaction costs. Also, monitoring the sale and the use of these permits would be difficult. In the case of manufacturers however, the transaction costs would be substantially lower. The two industries in particular that could be targeted in this strategy are the automobile and the oil industry. Both industries are relatively well organised with effective regulatory mechanisms in place. Thus a tradable permits system could be applied in this case.

However, since the 'polluting activity' is actually the use of the vehicle, and not the sale of vehicles, the tradable pollution permits would have to be based on estimated pollution caused by each industry. Also, while the system would encourage the production of cleaner vehicles and fuels, it would not discourage the higher usage of these vehicles. Thus the impact of such a strategy in the transport sector would be limited.

Out of the numerous applications of the tradable permits regime around the world, one successful instance in the transport sector is the US oil industry. In the US in the mid-1980's prior to the issuance of new, more stringent regulations on lead in gasoline, to allow flexibility in meeting the deadlines the Environment Protection Authority introduced a tradable permits system wherein refiners could trade lead emission rights. The rationale for such a regime was that while some refiners could meet early deadlines with ease, others could do so only with a significant increase in cost. Recognising that meeting the goal did not require every refiner to meet every deadline, EPA initiated an artificial market in the rights to use lead in gasoline to provide additional flexibility in meeting the regulations. Under this program a fixed amount of lead rights, that is authorising the use of a fixed amount of lead over the transition period, were allocated to the various refiners. Refiners who did not need their full share of authorised rights due to early compliance could sell their rights to other refiners.

Refiners had an incentive to eliminate the lead quickly because early reductions freed up valuable rights for sale. Acquiring these rights made it possible for other refiners to comply with the deadlines. As the strategy was designed purely as a means of facilitating the transition to this new regime, the lead banking program ended once more stringent lead content norms were introduced.

International experience

The international experience in the use of MBIs for environmental regulation in the transport sector reveals that most of these target either fuel consumption, vehicle price, or travel demand itself

Table 2.2 International experience in environmentally motivated fiscal policies

Instrument	Developing countries	Developed Countries
Price differential between leaded and unleaded gasoline	Hungary, Mexico, Philippines, Portugal, Taiwan, Thailand	Australia, Britain, Denmark, Finland, Germany, Luxembourg, Netherlands, New Zealand, Norway, Sweden, Switzerland
Price differential between ultra low sulphur diesel and ordinary diesel		United Kingdom, Sweden
Vehicle taxes based on emissions	South Korea	Austria, Belgium, Britain, British Colombia, Germany, Japan, Netherlands, Sweden
Taxes on non catalytic converter cars	Greece	Finland, Sweden
Higher tax on diesel cars		Germany
Annual road tax differentiated by vintage		Germany
Emissions trading	Chile	
Tax on lead acid battery		British Colombia, United States of America
Congestion pricing	Chile	Norway

Source. Pandey 2000 and Gupta 1999

Until late eighties, taxation policies of motor vehicles and motor fuels focussed primarily on raising revenue. Since early nineties many countries have implemented co-ordinated fiscal and environmental policies aimed at reducing vehicular emissions.

Fuels

The use of MBIs based on fuel prices as a mechanism has focussed on taxing dirtier fuels and subsidising cleaner ones. Differential fuel taxation has been used by a number of countries to promote the use of unleaded gasoline vis-à-vis leaded gasoline. However, the more contentious issue of the price of diesel vis-à-vis that of gasoline has not been addressed so widely. One exception to this was the United Kingdom where the then Department of Environment, Transport, and the Regions (DETR) had proposed fuel taxation based on the energy and carbon content. As a result, diesel was taxed higher than unleaded gasoline in the UK. However, even in the UK, the government went back on this policy a year before the last general elections.

The experience of countries in the use of economic instruments for promotion of clean fuels like CNG, Auto LPG and ULSD is given below.

Compressed Natural Gas

Many countries are known to be using CNG as an automotive fuel. There are 47 countries in the world using natural gas vehicles, some of them being Argentina, Italy, Pakistan, US, China, Russia etc A large number of countries have adopted differential fuel taxation to promote CNG.

- In *Argentina*, which has the largest number of NGVs in the world, the initial policies to encourage CNG included a differential of over 65% between gas and liquid fuel prices. The government offered no subsidies for CNG, instead the incentive for fuel switching stemmed entirely from the high taxes on gasoline. The Government also guaranteed gross margins for filling stations
- *Italy*: Natural gas is being used as a vehicular fuel since the 1940s in the country, with more than three thousand NGVs. The Government introduced a low level of taxation on natural gas in 1999, which was to rise incrementally over the following 5 years but still were to be lower than diesel or petrol taxes.
- *UK*: The fuel excise duty on petrol and diesel has been increasing by 6% per year in real terms while the actual duty on CNG has been frozen or reduced each year since 1993. In the budget of 2001, rates of duty on compressed natural gas (CNG) and liquefied petroleum gas (LPG) were cut by 25% so as to maintain the differential between these cleaner fuels and petrol and diesel.
- *Germany*: The government offers a low tax on CNG (15% of the service station price), and their government is committed to maintaining the low tax rate until 2009. The tax benefit for using CNG will be even more attractive in 2003, when a new ecological tax will be levied on petroleum fuels.
- *Russia*: Use of natural gas is encouraged by lower pricing of natural gas and rising taxes on petrol. The Russian Government limits the retail price of natural gas for vehicles such that it does not exceed 50 % of the price of the lowest grade gasoline. At present there are around 30 thousand natural gas vehicles in the country.

Auto LPG

The use of LPG in the transport industry has become quite widespread in a number of countries. Over 5 million LPG vehicles are in operation worldwide. Italy has the highest number of vehicles running on the fuel with around 1,200,000 followed by South Korea with 790,000 and Australia with 530,000. Other countries with a high level of penetration of auto-LPG (also known as autogas) are Netherlands, Japan, USA, Canada and Thailand.

- *Japan*: At least 90% of all taxis run on LPG in Japan. The Japanese Government encourages the use of autogas through a combination of fiscal incentives, grants for the conversion or purchase of autogas vehicles and the installation of dispensing facilities, and stringent regulations governing noxious emissions in designated urban areas. Excise taxes on autogas are about one-third of those on diesel and one-fifth of those on gasoline. As compared to gasoline and diesel, no customs duties are levied on imports of LP Gas.
- *Italy*: Autogas use is encouraged through a combination of fuel-tax rebates, vehicle-conversion subsidies and traffic regulations favouring LPG vehicles on environmental grounds. Autogas currently enjoys an excise tax advantage of US$0.33/litre against gasoline and US$0.21/litre against diesel.
- *Australia*: The main reason behind the successful development of the LPG market is the complete excise tax and state tax exemption on the fuel. Although excise duties on gasoline and diesel are not high by industrialised country standards, pump prices of these fuels are still more than twice the level of autogas prices.
- *South Korea*: The use of autogas was initially restricted to public transportation. The demand for autogas underwent a sharp rise when the government extended the use of LPG beyond taxis and public buses. The main reason for success of autogas was that it was priced at 25% of gasoline price. However, LPG is likely to lose its competitive edge with a steady rise in the taxes raising the price by 6% per year for a period of 5 years till it is 60% of the gasoline price.
- *UK*: Strong fiscal incentives have been introduced for autogas, the most important being a large excise duty differential between autogas and gasoline and diesel. Each year, over the last 8, years duty on LP gas has either been frozen or reduced owing to its environmental advantages. The UK Government gave a major boost to autogas in March 1999 when it cut the excise duty by 29% while raising duties on gasoline and diesel by more than 8%. In November 2000, the gasoline – autogas differential amounted to 38

pence per litre (US$ 0.53 per litre), making autogas at the pump just under half the price of gasoline in per litre terms and around 40% cheaper in energy terms. In the March 2001 budget, the duty on LPG was reduced by 3 pence per litre and duty was frozen in real terms until 2004.

- *Netherlands*: LPG is not seen as an alternative motor fuel, but as a regular fuel. All filling stations along the motorways supply LPG. The excise duty on petrol is higher than that on LPG.
- France: The reduction of the tax on autogas by 70%, and the raising of the tax on diesel in January 1996, stimulated the growth of autogas as a road fuel in France.

Ultra low sulphur diesel

A differential tax regime in favour of low sulphur diesel as opposed to ordinary diesel has been used in a number of countries to promote cleaner diesel The experience of various countries is given below:

- *Sweden*: It was the first country to have introduced ULSD. It was introduced by the Swedish Government with Environmental Classifications, E1 (less than 10 ppm Sulphur) and E2 (below 50ppm Sulphur) from 1st Jan. 1991. The E2 grade was discontinued in 1996. E1 product was given a very high tax incentive making it attractive enough for some oil companies to switch all the diesel fuel to the E1 grade. The tax differential between E1 and E3 (350 ppm max) in 2000 was 19 US cents per gallon. As a result of this high tax incentive, the market share of E1 is around 100% in Sweden.
- *UK*: The Government used duty differentials to encourage the oil industry to shift to Ultra Low Sulphur Diesel (ULSD). In 1997, the Government gave a one pence differential to ULSD over conventional diesel. This differential was raised to two pence in 1998 and further to three pence the next year. As a result of these incentives, by August 1999 all oil companies began to supply and market the fuel (HM Customs and Excise, November 2000).
- *Denmark*: A tax incentive of Euro 0.012 per liter for 50-ppm sulphur diesel was introduced from 30 June 1999. The result was a nearly 100% penetration of 50 ppm sulphur diesel in the Danish market from the 1st July 1999.
- *Finland*: The government offers Euro 0.024 per liter tax break on diesel containing up to 50 ppm sulphur.
- *Norway*: Euro 0.028 per liter tax break on diesel with no more than 50 ppm sulphur is offered.

- *Germany*. The government will offer tax breaks for sulphur-free gasoline and diesel from 2003. The tax break of Euro 0.015 per litre for fuels with no more than 10 parts per million sulphur will be offered from 1 January 2003 until 1 December 2005. The incentives are expected to accelerate the EU-wide shift towards sulphur-free motor fuels.
- *Hong Kong*: The government adopted a tax incentive scheme in 2000 of concessionary duty of $1.11 per litre, which made diesel fuel with less than 50 ppm sulphur less expensive than diesel fuel with more than 50 ppm. As a result, all diesel fuel now sold in Hong Kong is 50 ppm or less.
- *US*: the Environmental Protection Agency (EPA) of US issued final rules late December 2000 to cut sulphur levels by 97% from 500 parts per million/gal to 15ppm/gal. The new standard will be effective for 75-80% of total diesel fuel supply by June 2006. The remaining suppliers have until late 2009 to comply. Refiners will receive credits, which they will be able to buy and sell, for meeting the standards early.

Vehicles

Vehicle taxation based on the potential emissions loading from a vehicle in its entire life span has been very popular. Most countries in the European Union have imposed such levies on vehicles that do not comply with the EU recommended standards. Specific proposals to promote the production and purchase of cleaner vehicles are detailed in Chapter 3.

Incentives for alternate fuel vehicles/low emission vehicles

A number of countries subsidise the purchase of low emission vehicles. For instance, in Japan, tax deductions are offered for the purchase of battery-operated vehicles and alternate fuel vehicles. In the UK, a government funded group called Powershift offers grants to help offset the incremental price of cleaner vehicles, giving subsidies of 45-70% for conversions of vehicles to CNG or LPG (www.westport.com). Over the five year period of Powershift operation, the number of automotive LP Gas vehicles has risen from an almost negligible number in 1997 to 20,000 in 2000. The purchase of natural gas vehicles would earn tax concessions in all countries of the European Union until 2009. Tax advantages are given for LPG vehicles in France, Netherlands, Sweden, Italy, Germany etc.

In Australia, the government provides a package of federal programs to help in establishing the NGV industry. The programs include the Alternative Fuels Conversion Program which give funding up to 50% for conversion to CNG, the

CNG Infrastructure Program for installing refuelling facilities, the Diesel and Alternative fuel grants scheme which ensures that the fuel price advantage of Natural gas over diesel is maintained and the Alternative Fuels Grants scheme for urban buses.

In US, the National Energy Policy Act (E P Act) allows a federal tax credit of 10 percent of the cost of electric vehicles. The credit is based on the purchase price of the vehicle and may not exceed $4,000. The credit is available to vehicles placed into service after June 30, 1993, and before January 1, 2005. The E P Act also allows for a maximum of up to $2,000 as a federal tax deduction for clean-fuel vehicles that use clean fuels such as ethanol, methanol, natural gas or propane (liquefied petroleum gas or LPG). The federal tax deduction is based on the incremental cost of equipping the vehicle to use the clean fuel, the amount above the price of a conventional gasoline-only fuelled vehicle. The federal deduction is available for vehicles placed into service after June 30, 1993, and before January 1, 2005.

Differential vehicle taxes

In Germany, new passenger cars are taxed based on their emissions. The share of low emission cars in the new passenger cars segment has increased significantly as a result of the benefits given. In Netherlands, lower sales tax was imposed on cars that complied with future EU standards. Consequently, share of future EU standard cars rose from 37% to 70%, much faster than the government expected. In UK, the Government introduced changes to Vehicle Excise Duty (VED) in March 2001 to benefit new car owners with smaller, more energy efficient cars. The rate of VED new car owners now pay is directly linked to their carbon emission levels. The least polluting cars have to pay the lowest annual averages. Economic instruments are also widely used to promote specific abatement technologies such as catalytic converters in cars.

Measures for in-use vehicles

Since the emission intensity of older vehicles, other things remaining same, is likely to be more, some specific measures are required to discourage use of older vehicles. In Singapore, various such measures have been adopted. The life of certain categories of vehicle is fixed, at the end of which the vehicle must be scrapped While taxis must retire at the end of 7 years of age, buses and goods vehicles are not allowed on road beyond 15 years. Similar policies have been adopted for commercial vehicles in Delhi also. In Mumbai also a similar phase out program would be implemented, all transport vehicles older than 8 years would be phased out in 2003/4 unless converted to cleaner fuel. Though there are no statutory limits on the life of other categories of vehicles in Singapore, various economic incentives are provided for early scrapping of vehicles. The registration fee is waived off for replacing older vehicles. An interesting aspect to this policy is that the waiver is higher for newer vehicles. As a result, a higher fleet turnover rate is encouraged. In Germany too, for addressing the issue of in-use vehicles, the annual road tax for vehicles is differentiated according to the vintage. High taxes on cars not meeting the Euro emission norms resulted in retrofitment of 700,000 cars with catalytic converters. Some countries offer capital incentives for conversion of vehicles to alternative fuels. For instance in Western Australia, the State Government in October 2000 introduced a new vehicle/vehicle conversion incentive scheme for private vehicle owners. The immediate response of this was a doubling of the rate of vehicle conversions. Being targeted at private motorists, this scheme complements the Commonwealth's Alternative Fuels Conversion Program.

Traffic

In major conurbations of both developed and developing countries, congestion is a significant problem. The congestion phenomenon is one of excess demand, given a fixed road network. The traditional method of effectively curtailing congestion has been a supply side solution, the expansion and improvement of roads. However such a strategy is restricted by increasingly tight fiscal and physical constraints.

Traffic restraint can also be achieved via either the regulatory approach on quantity with command and control measures or using market based instruments. Examples of the regulatory approach to roadway usage are to control the physical number of vehicles, for instance, by an 'odds and evens' system[a] and by restricting the number of personal vehicles in congested areas[b] (May 1991). Such measures have been found to be ineffective when applied permanently (Eskeland 1992). Other traffic management measures include behavioural incentives such as staggered working hours, park-and-ride and vehicle sharing (carpooling and taxi sharing). Staggering would reduce congestion during the peak hour, thereby creating incentives for people to switch back to their preferred times. Park-and-ride facilities are costly in terms of space and construction, and have failed to have the desired impact. For instance, in the Singapore Area Licensing Scheme, motorists found that switching modes was onerous despite the provision of shuttle bus services. Vehicle sharing has but a small effect on reducing congestion relative to incentives that increase the provision and use of public transport in the medium run. Cars with four or more people were exempted from charges in Singapore's Area Licensing Scheme prior to June 1989, but are now charged when they enter the Restricted Zone during peak hours because authorities noted frequent pick-ups just before the zone boundary. The same kind of abuse also occurs in some San Francisco Bay Area cities in response to the fiscal incentive that is inadvertently created when car-poolers are exempted from tolls on bridges and tunnels or given preferential access to road capacity. In general, regulatory approaches do not prove to be very effective in managing demand in an efficient manner because of their inflexibility.

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[a] The odd/even number plate system prohibits the use of private vehicles one day a week, as has been done in Mexico City since November 1989 mainly because of its air pollution problem (Carbajo 1992).

[b] Aside from public transport, government and residents' vehicles, private vehicles are forbidden to enter a cordon surrounding central Milan, Italy, during the day between 7:30 a.m. and 4:30 p.m. (Orski, 1992).

However, pricing can address the problem. A review of the international literature on regulating road usage using MBIs reveals that strategies aimed at regulating the flow of traffic and reducing congestion in general have been based on a rational pricing of road space, that is, congestion charges should reflect the true scarcity value of transport infrastructure. For instance, in Singapore, access fees for the central business districts have been levied to reduce the congestion during peak hours. These are important elements of any abatement strategy for the transport sector. Congestion charges in Singapore are enforced as part of an elaborate Area Licensing Scheme (ALS). In this regime, a number of congested corridors in the city have been identified where a charge is payable by every vehicle. Electronic Road Pricing (ERP) is simply an electronic ALS. It is designed to automate the road pricing system. The congestion charges used in Singapore are given in Table 2.3.

Table 2.3 Congestion charges in Singapore (Singapore dollars)

Vehicle type	Arterial roads	Expressway
2 wheelers	0.25 - 1.25	0.25 - 1.25
Cars	0.50 - 2.50	0.50 - 2.50
Taxis	0.50 - 2.50	
Light commercial vehicles	0.50 - 2.50	
Small buses		
Large buses		

Source. www.lta.gov.sg (Accessed on 19 February 2002)

Economic instruments for mitigating transport emissions

The application of economic instruments in the transport sector is recognised to be more complex than in other sectors due to the mobile nature of source of emissions (Tietenberg 1992). Pollution in this case is only caused to a temporary location of the source in an area. Thus it is not possible to tailor emissions to local conditions. As a result, emission norms based on desired air quality in dense areas may impose a disproportionately higher cost on less dense areas. Also, as vehicles have to be where people are, relocation is not a viable strategy. Thirdly, the number of polluters here is substantially more than stationary sources – there are about 35 million vehicles registered in India. Consequently, enforcement is significantly more difficult and expensive. Finally, as mentioned earlier, emissions from the urban transport sector are rapidly growing and attention is increasingly being focussed on abatement strategies in this sector.

The optimal design of strategies in the transport sector to control emissions in the transport sector would have to consider the number of agents to be regulated as also the change in the emission patterns over the lifetime of the vehicles. The economic instruments could then be applied either at the point of manufacture or at the point of usage.

In case of the former, deterioration in the emissions performance during the lifetime of the vehicle would have to be factored in the design of the instrument. Also the implication of such a strategy would be limited as new vehicles form a small proportion of the total vehicle fleet and the benefits from such a strategy would be realised only in the long run. In addition, influencing the tax structure to internalise the environmental costs could also raise the prices of newer vehicles and thus leading to a longer lifetime for older vehicles. Nevertheless, the import of this strategy cannot be understated as the choice that a commuter exercises at the time of purchase of a vehicle affects the emissions during the entire lifetime of the vehicle.

The use of congestion charges to reduce emission at hotspots could address the concerns regarding conventional commuting patterns, which lead to denser concentrations of vehicles in specific areas, in turn leading to higher emissions. For instance, congestion charges in urban areas would address concerns of vehicle emissions more effectively than more stringent vehicle emission norms that would imply 'over control' in rural areas.

Market based instruments in India

Market based instruments (MBIs) for pollution control were introduced in India as early as 1974. Water (Prevention and Control of Pollution) Cess Act, 1977 required designated industries and local utilities to pay a cess for water consumption. However the basis of this cess was less embedded in the pigouvian philosophy and more as a source of revenue for cash strapped state pollution control boards. Thus no attention was paid to the level of emission and its impact on the environment.

In addition to water cess, there is a range of fiscal instruments for investment in pollution control systems. These include 100% depreciation for pollution control equipment, reduced customs duty for pollution control equipment, and income tax exemptions when expenditures are undertaken for conservation of natural resources. However such incentives are usually for specific abatement technologies and activities and do not in any way provide dynamic incentives for technological innovation and diffusion. Also since most of these are end of the pipe treatment technologies, a more efficient use of the resources is in no way promoted.

Obviously there is considerable scope for improvement given the current state of MBIs in India and the command and control strategies. The flexibility provided by this system implies considerable cost savings. Also a cost-minimising environment would provide continuous impetus for the development of new production and discharge reduction technology. Thus this would be a good time for India to jump the learning curve and improve the efficiency of pollution control strategies.

Unfortunately, as stated earlier, pollution control strategies in India do not rely on the use of market based instruments. In particular, the annual budget exercise, both at the state and the union government levels, does not make any progress in this direction. In this regard it is important to note two peculiarities of the Indian policy making framework. One, economic instruments have been used by the government to regulate the economic and social behaviour of the people for a long time in India. However these policy decisions do not consider the environmental impacts of economic activities or the impact of the policy changes on the environment in the policy making process. Thus if a tax/subsidy has a beneficial environmental impact, it is only incidental. For example, the prices of all petroleum products, till very recently, were not market determined and decided by the state taking into account the cost of production of each fuel and the socio-economic characteristics of the consumers of the fuels. However the emissions caused from the use of these fuels and their impacts on the environment was not a consideration.

Secondly, even though in India, the ultimate authority for environmental regulation is vested with the central government, the power to use a number of economic instruments for development purposes rests with the state governments. For instance, most state governments subsidise the agricultural sector for water and electricity use. Additionally some of these taxes/subsidies have significant environmental impacts. Hence in the use of such MBIs, the power of the Central government is limited. Correspondingly the importance of the annual financial exercise, the budget as far as the use of these MBIs in pollution control strategies is limited.

Market based instruments in transport in India

In India, though the government has used economic instruments to regulate the economic and social behaviour of the people for a long time, their potential has not been utilised in the environment regulation policies. Also, policy decisions in the transport sector are not driven by the environmental considerations. As discussed earlier, environmental regulation in the transport sector has seldom used MBIs.

There are however, various fiscal instruments in the Union as well as the State Government budgets that influence the emission loading from the transport sector. These include the central sales tax, the customs duty and excise duty, which are in the purview of the Central Government, and sales tax in the budgets of State Governments. Also allocations for various activities and government instrumentalities, like State Transport Undertakings (STUs), impact the environment. Finally, there are other instruments also available such as depreciation allowance, and R&D allowances to the manufacturers to encourage a shift towards production of less polluting vehicles.

The Union Budget

The Central Excise duty is an indirect tax levied on goods manufactured in India. It is collected under the Central Excise Act, 1944 at the rates specified under the Central Excise Tariff Act, 1985. Under the excise laws, the following are the various kinds of duties that are levied.

- *Basic Excise Duty*: This is the basic duty levied under the Central Excise Act on the cost of production of a commodity, that is the ex-factory price.

- *Special Excise Duty*: This special duty is levied under special circumstances where the levy of such additional duty is justifiable or is necessary. This is a levy over and above the basic excise duty.
- *Additional Duties of Excise*: These are additional duties leviable under different enactment on specific commodities in addition to the above two.

Since 1999, there has been a marked move towards rationalisation of the excise duty structure so as to reduce the multiplicity of the rates. In the pre-1999 period, there were 11 ad valorem rates of basic excise duty- 5%, 8%, 10%, 12%, 13%, 15%, 18%, 25%, 30%, 32% and 40%. These rates were reduced to 3 in the budget of 1999/2000, namely a central rate of 16%, a merit rate of 8% and a demerit rate of 24%. The special excise duty rates that were introduced in this budget were 6%, 8% and 16%. In the budget of 2000/01, the excise duty was renamed as Central value added tax (Cenvat). A uniform Cenvat of 16% was levied. However, in certain cases like LPG and CNG, a concessional rate of 8% is levied. Also, the three rates of SED of 6%, 8% and 16% were reduced to a single rate of 16%. The rationalisation of the tax structure for automobiles over the years is given in Table 2.4.

Table 2.4 Fiscal instruments in the budget that have environmental impacts -Central Budget

		Excise duty				
		2000/2001		1999/2000		1998/99
		Basic	Special	Basic	Special	Basic+Spl
Motor Vehicle	Motor Cars	16%	16%	24%	16%	40%
	MUVs	16%	16%	24%	6%	30%
	Scooters & Motor Cycles	16%		24%		25%
	Mopeds	16%		16%		15%
	Commercial vehicles			16%		15%
	Taxi	16%		24%		25%
	Buses	16%		16%		15%
Motor vehicle parts		16%		16%		15%
Tyres	For Cars & buses	16%	16%	24%	6%	30%
	For two wheelers etc	16%	16%	16%		13%
CNG		8%				

Gasoline	16%	16%	24%	8%	32%
Diesel	16%		16%		15%

Source. www cbec gov in

The Delhi State Budget

The Delhi Sales Tax Act provides for the levy of sales tax at single point. The main scheme of Delhi Sales Tax Act envisaged the levy of tax at the last point of sale. However, some of the items, like motor vehicles, have been brought under the first point tax system. The rates range from 1% for necessities to 20% for high priced consumer goods. These rates are in the following slabs- 0%, 1%, 4%, 8%, 12%, 20%. In the transport sector, a uniform tax rate of 12% is levied. The details are given in Table 2.5.

Table 2.5 Fiscal instruments in the budget that have environmental impacts -Delhi State Budget (Sales tax regime)

Category	2000-2001	1999-2000
Motor vehicle other than trucks	12%	6%
Trucks	12%	4%
EURO II compliant 2 wheelers	12%	4%
Non EURO II compliant 2/3 wheelers	12%	6%
Three wheelers	12%	6%
Motor vehicle bodies	12%	10%

Source. www delhisalestax.com

In the Delhi State Budget 2001/02, the transport sector has been accorded the highest priority in terms of outlays. The outlay for this sector has been increased form Rs. 6.18 billion in 2000/01 to Rs. 9.11 billion in 2001/02. The strategy for development here is augmentation of urban transport infrastructure. The schemes include construction of flyovers and augmentation of public transportation by means of financial support for purchasing clean fuel buses and conversion of the existing buses to clean fuel mode, expansion of Regional Rail Network and to the Mass Rapid Transit System (MRTS).

3

Incentives for cleaner automobiles

The Indian automobile industry has been a rapidly growing sector of the economy. It has undergone several changes in the past two decades. Rapid investment has been taking place in the infrastructure, design and development, and marketing of automobiles. A number of steps have been taken to improve the energy efficiency of vehicles and reduce their environmental impact.

This chapter assesses the volume of investment necessary and the implication of improved technology on the cost of production of vehicles. analyses the various incentives that need to be given to the automobile industry to promote cleaner and more efficient technologies. Interviews were conducted with the various automobile manufactures to assess the quantum of investments that would be necessary for upgrading the engine design to meet increasingly stringent emission norms. The implications of these investments on vehicle prices were estimated. Based on the incremental costs, the need for incentives was evaluated. Finally strategies for the promotion of cleaner technologies have been suggested.

Automobile industry in India

The automobile sector in the country has gone through three distinct phases: the early regime of licensing until 1983; partial liberalisation in 1983/84, which led to the entry of Maruti and the proliferation of two-wheelers and LCVs (light commercial vehicles); and the phase in the 1990s when economic reforms were introduced in the economy as a whole. The early regime was governed by regulations where imports, collaborations, and equity ventures were severely restricted by the government. Technology transfer from foreign companies was subject to government approvals. The entry of the first multinational company into the automobile sector, namely the Suzuki Motor Company (in collaboration with Maruti) during the second phase, redefined the automobile sector and led to its tremendous growth. The government on the one hand encouraged the company by giving it fiscal concessions (lowering import and excise duty) and on the other forced the company to adopt a phased manufacturing programme whereby the company had to increase the indigenous component in the production process gradually. The liberalisation measures, since early 1990s, have led to a further increase in the domestic as well as foreign investment in the automobile sector. There has been a phenomenal growth in the sales of different types of motor vehicles in India (Table 3.1). However, the growth has not been even across all categories of motor vehicles, with personal modes of transport (scooters, motor cycles and cars/jeeps) dominating sales growth.

Table 3.1 Annual sales of motor vehicles in India

Year	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98
Two wheeler	1738721	1810661	1608707	1501123	1763677	2208422	2658227	2972309	3044124
Cars	179046	177942	167244	146195	210672	265612	353233	407699	409957
UVs	44207	28123	34951	33958	49478	50919	65780	93401	89937
LCVs	47872	56007	52637	53560	74534	94912	128709	127925	107523
M&HCVs	75815	75661	85143	67981	76245	103733	128362	151117	92621

Source. ACMA, various issues.

Two and three wheelers

India is the second largest manufacturer of two-wheelers in the world and is one of the very few countries manufacturing three wheelers. The Indian two-wheelers industry can be broadly classified into three major segments – scooters, motorcycles and mopeds. The demand for scooters is on the wane and witnessed a 10% fall in 2000/01. With the gradual shift in demand towards motorcycles, sales in the scooter segment is expected to fall further, while the motorcycle and scooterette segments would grow.

Cars

The Indian passenger car industry today is significantly different from the near monopoly market of the late 1970s. The restrictive policies of the Indian government did not allow foreign players to set shop in India and in the absence of adequate technology and purchasing power it resulted in the slow growth of the industry even after a long time since independence. As discussed earlier, the entry of Maruti Udyog Ltd, a joint venture of the Government of India with Suzuki of Japan in 1983 and a more favourable policy framework resulted in a growth rate of 18.6% in car sales between 1981 and 1991. After witnessing a downturn from 1990/91 to 1993/94, car sales bounced back to register 17% growth rate till 1997/98. Since then, the economy slumped into recession and this has affected the growth of the automobile industry as a whole. As a result car sales remained almost stagnant in the period between 1997/98 and 1999/2000.

On the basis of price, the Indian car industry can be classified into economy or the 'small' car (upto Rs 0.3 million), mid-size (Rs 0.3-0.5 million), luxury car (Rs 0.5-1 million) and super luxury car segments (above Rs 1 million). The economy segment dominates with a market share of about 80% of total car sales in 2000/01. Taking into consideration the rise in disposable income levels and necessity of personal transportation as a result of deficient public transportation means, the demand for cars is expected to increase in the absence of significant policy interventions.

The flood of new entrants into the car industry as a result of liberalisation has led to a complete transformation of the sector. The car segment is flooded with new models from new and existing players, a visible shift from a constrained supply situation to a surplus. In the last decade or so, as many as 30 models have been launched. The capacity of car production has increased substantially in the last three years and is expected to grow manifold in the coming years, in even excess of the increase in demand. The low capacity utilisation is expected to result in greater competition between the car manufacturers. The industry may also witness a shake out resulting in withdrawal of players from the segment in future.

LCVs and HCVs

In any economy, road transport accounts for a major share in the overall transition of goods and people. In India, road transport has been on the uptrend with the total goods traffic on roads increasing from 13% in 1951/52 to 53% in 1991/92 and the total passenger traffic going up by 28% from 1951/52 to 80% in 1991/92. The Commercial Vehicle (CV) sector can be broadly classified as Light Commercial Vehicles (LCVs) and Medium and Heavy Commercial Vehicles (M&HCVs) based on the Gross Vehicle Weight (GVW), which constitute 41% and 58% of the total CV sales respectively. In the M&HCV segment, trucks command a dominant share of 70%.

The major players in the Commercial Vehicle Segment are Ashok Leyland Ltd, Hindustan Motors Ltd, Telco, Volvo India Pvt.Ltd, Bajaj Tempo Ltd, Eicher Motors Ltd, Mahindra & Mahindra Ltd, Swaraj Mazda Ltd with almost half of the M&HCV players also being in the LCV segment. The infrastructure development, planning and outlay directly contribute to the sales and the sophistication of technology used in the majority of commercial vehicles. The sales volumes are also subject to fluctuations due to several other factors such as government policies, fuel prices, better monsoons, rural incomes and replacement demand to name a few.

Outlook for the industry

The current economic slowdown in India has also affected the Indian automobile industry with a negative growth rate of 2% in 2000/01 compared to 15% positive growth in 1999/2000 (www.siamindia com) accessed on 21 February 2002). This decline can be traced to a decline in nearly every vehicle catergory except multi-utility vehicles, three wheelers, and motorcycles. Nevertheless, there has been a rise in overall exports even though some segments such as passenger cars have seen a decline. Some of the factors contributing to the poor performance of the industry are low level of investments in the public and private sectors, inadequate infrastructure development, lack of business confidence, high cost & non-availability of capital, overall recession in the economy and the resultant slow down in the industrial production (www.siamindia.com) accessed on 21 February 2002).

Environmental standards in the automobile industry

Reducing vehicular emissions calls for interventions to improve both vehicle technology and fuel quality. Further, it is important to look at possible improvements in both conventional engine technologies and fuels and the viability of alternative technologies.

In India, the formal specification of emission standards for vehicles began only in 1991. Thereafter, the standards have been made progressively more stringent, thereby narrowing the gap between the standards applicable in the developed world and in India (Table 3.2). Emission standards for different categories of vehicles including transport vehicles were introduced in the year 1990 and subsequently modified with stringent standards effective from 1992, 1996 and 2000. Euro-I norms have been brought into force with effect from April 2000 through out the country for all categories of vehicles. However, Bharat Stage-II norms (equivalent to Euro-II) have been brought into force only in NCT, Delhi with effect from April 2000 and further extended to the city of Mumbai, Chennai and Kolkata in 2001. The Bharat Stage-II norms are applicable for vehicle up to 3500 kg GVW. Draft Bharat Stage-II norms for commercial vehicles have also been notified and are in the process of being finalised. Further, fitment of Catalytic Converter has been made mandatory for all four-wheeled petrol driven vehicles for registration in the four metro cities and other 45 cities of the country. From April 1995, mandatory fitment of catalytic converters in new petrol passenger cars sold in the four metros of Delhi, Calcutta, Mumbai and Chennai along with supply of Unleaded Petrol

Need for incentives

The mandated reduction in emission norms by governments would have cost implications that may affect the financial viability of the automobile industry and dampen the demand for automobiles (Details in Annex 3.2). As illustrated in Chapter 2, the international experience reveals that governments have traditionally facilitated the improvement in technology by giving concessions to the industry. Also, reducing the incremental cost of technology to the consumer by devising various incentives help in better penetration of these technologies before their mandated deadlines. This section evaluates the need for incentives on a number of parameters.

Implications of cleaner technologies

Table 3.3 summarises the incremental cost of various modes and aggregates them based on the vehicle sales in 2001/02. These have been estimated on the basis of interviews with automobile manufacturers. The details of the technologies cited by the manufacturers and the cost implications are given in Annex 3.2.

Table 3.3 Incremental Cost to be incurred by the manufacturer

Category	Sales	Rs. per Vehicle		Total Cost (billion Rs)	
		Bharat Stage II	Bharat Stage III	Bharat Stage II	Bharat Stage III
Two Wheelers 2-Stroke	1794844	NA	3500	0	6.28
Two Wheelers 4-Stroke	3216472	NA	5000	0	16 08
Three Wheelers	240736	NA	5500	0	1.32
Passenger Cars	696255	30137	50395	20.98	35 08
Trucks and Buses	88756	61866	162148	5.491	14.39
Total cost				26.47	73.2

Implications of increased costs

It is important to assess the quantum of incremental costs so as to determine the need for concessions to the automobile industry to undertake this investment. The increase in the costs of various modes due to improved technologies is described in Table 3.4. It appears that these costs are not significant and could

(ULP) was affected. Availability of ULP was further extended to 42 major cities and now it is available throughout the country. The emission reduction achieved from pre 1989 levels is over 85% for petrol driven and 61% for diesel vehicles from 1991 levels (TERI 2000).

Table 3.2 Passenger car mass emission standards (grams/kilometre) in India

Category	Pollutant (g/km)[a]	1991	1996	1998	2000
Cars running on petrol	CO	14.3-27.1	8.68-12.4	4 34-6.2	2.72
	Hydrocarbons	2.0-2.9			
	HC + NOx		3.4-4 36	1 5-2.18	0.97
Cars running on diesel	CO	14	5 0 - 9 0		2.72 - 6 90
	HC	3 5			
	NOx	18			
	HC + NOx		2.0 - 4 0		0.97 - 1.70
	PM				0 14 - 0 25

[a] CO – carbon monoxide; HC – hydrocarbons, NO_x – oxides of nitrogen; PM – particulate matter

Source Bose 2000

Nevertheless, it is well recognised that current vehicle technologies in India are inferior to those in the developed world, especially for heavy-duty diesel vehicles. Diesel vehicles do not have particle traps, which help to reduce the emissions of particulate matter. Catalytic converters, coupled, with use of unleaded petrol were introduced only recently after the emission norms were made more stringent in 1996. Buses are built on a truck chassis and designed for optimal speeds that are possible only on highways and not within the city. The largest segment of the vehicular fleet, namely two-wheelers, mostly uses the highly polluting two-stroke engine.

Part of the reason for continuing with inferior technologies has been that the above standards have not been laid down as part of a well-planned strategy but have largely been ad hoc, often prompted by judicial interventions. Besides, a number of other policies influence the choice of the technology in the absence of a well-published agenda. This makes the industry uncertain and thus reluctant to invest in upgrading the technology. This situation can be best corrected by mandating a gradual introduction of cleaner technologies in phases spelt out in a clear and time-bound action plan with adequate lead time, to allow the automobile and oil industries to make the required investments and also have a longer term perspective on investments.

be easily absorbed. In case the improvement in fuel efficiency of the vehicles is taken into account, the net impact in a number of modes is positive.

Table 3.4 Implications of increased cost in the automobile industry for BS II

	HCV	Taxi	Bus	Car	2 wh 2 st	2 wh 4 st	3 wh
Incremental cost (Rupees)	61866	30137	61866	30137	3500	5000	5500
Life (Years)	8	8	8	15	15	15	8
Capacity utilisation	10.20[a]	1.76	49.60	2.50	1.5	1.5	1.76
Daily km	306	85	200	27	13.5	13.5	100
Incremental cost per Tonne (Pax) km	0.05	0.55	0.02	1.22	0.47	0.68	0.09
Gain Rs/km in fuel efficiency	0.11	0.16	0.06	0.16	0.01	0.01	
Net Gain / Loss	0.10	0.07	0.05	0.00	-0.05	-0.08	

Similarly, estimates of potential inflationary impact of these technology upgrades, based on the weights of these commodities in the Wholesale Price Index, are given in Table 3.5. These are approximate estimates implicitly assuming that demand would remain unaffected with increase in price, that is inelastic demand, and would need to be modified based on the demand elasticities of these commodities. These do not appear to be significant and the incremental costs are not significant enough to merit concessions being demanded by the automobile industry.

Table 3.5 Inflationary impact of technology upgradation to BS III

	HCV	Taxi	Bus	Car	2 wh 2 st	2 wh 4 st	3 wh
Incremental cost (%)	0.08	0.10	0.08	0.10	0.16	0.13	0.07
WPI weight	2.02	0.84	0.26	0.84	0.32	0.32	0.07
Impact	0.156%	0.084%	0.020%	0.084%	0.051%	0.040%	0.005%

However, to ensure the political acceptability of the proposed norms, it may be necessary to provide incentives in case in the entire burden of the incremental cost is passed on to the consumer. This would in turn depend upon the market structure. In a competitive market, the manufacturer would absorb incremental costs in the market, as is the case with cars. The competition between manufacturers would ensure that cost increases are largely absorbed by the manufacturers. However, in the case of the HCVs and the three wheeler segments with firms having substantial market monopoly, state intervention may be necessary to ensure that the consumer is protected. Also, as HCVs and three wheelers are intermediate goods and not final consumption goods, increase in their prices would have a cascading effect.

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[a] Tonnes

Promoting cleaner technologies

The role of market based instruments in promoting cleaner technologies has been extensively documented in Chapter 2. It is imperative that the pollution control policies in the transport sector realise the efficiencies that would arise from a greater use of economic instruments in the transport sector, as also provide an incentive for the automobile industry to move to cleaner technology. These should also persuade the consumers of motor vehicles to purchase relatively cleaner vehicles. Finally, market based instruments should also internalise the costs that arise from emissions due to vehicle usage, thus ensuring that user cost in the transport sector are the true costs. Hence, it is necessary to develop a framework for the use of economic instruments in the transport sector.

Incentives for promoting cleaner vehicles

The review of international literature and consultations with stakeholders and experts in the sector reveal a number of incentives available to promote the use of cleaner technologies in the automobile sector. These can be broadly classified into two categories – incentives for incurring the additional capital investments and interventions in the tax regime to influence the price of the vehicle. Of the latter, some of the instruments available are under the purview of the central government, and others under the state government. This section discusses the various incentives, their relative merits, and their applicability in the Indian context.

Subsidies for capital expenditure

Capital expenditure can be incentivised using a number of instruments such as low interest loans, larger depreciation allowance, lower tax rates for equipment purchase for plants and machinery. Soft loans and faster depreciation act as incentives for manufacturers to incur the up front cost at the earliest.

However, these incentives are not enough by themselves and need to be supplemented with mandated deadlines and standards. Also, it is not possible to provide such a subsidy universally and needs to be targeted at specific activities and commodities. This would be akin to mandating technologies and equipment and would necessarily realise a higher cost outcome as described in Chapter 2.

This would also impede innovation and the development of cheaper technologies that would achieve the same result.

Custom duty waiver for auto components used in BS II and BS III compliant vehicles is another option. The current customs duty regime permits a lower duty of 5% for cleaner technologies. For instance, the customs duty on CNG conversion kits is levied at 5% under this scheme as described in Chapter 2. This is a possibility that could be explored for the capital equipment that would have to be imported for manufacturing cleaner vehicles. However, as in the above case, as the technology that receives the benefit is mandated, there is no incentive for the manufacturers to opt for the least cost technology and would be a deterrent to innovation. Further, it is arduous to assess whether these concessions are used for the right purpose.

Interventions in vehicle taxation

As mentioned earlier, the various taxes on vehicles can be classified as being either administered by the central government or the state government.

Instruments under the state purview

The two key instruments under the purview of the state government are sales tax and the registration charges for motor vehicles. State sales tax contributes substantially to the overall price of the vehicle. For instance, the present sales tax on all categories of vehicles is 12% in Delhi. Also, since influencing the sales tax would directly impact the pricing of a vehicle, this instrument can be better targeted. Thus influencing the sales tax forms a critical strategy recommended. However, since sales tax is a state subject, the ability of a central government agency to influence the sales tax is limited. It would take a concerted effort on part of all states in the country to implement this strategy. Also, since sales tax forms a substantial part of the state government revenues, it may be difficult to implement sales tax concessions for cleaner vehicles. Hence, it would be necessary to ensure that the suggested interventions are revenue neutral.

The other intervention that can be effected by the state governments is the road tax and registration fees. However, these have limited impact on the price of the vehicle.

Instruments under the purview of Central Government

The two instruments available here are the central excise duty – the Cenvat, and the Central Sales Tax. As described in Chapter 2, the Central Excise duty is an indirect tax levied on goods manufactured in India. Excise duty currently prevailing in India is 16% and contributes substantially to the price of vehicle. Differential Excise duty structure can be offered to the vehicles according to the emission standards of the vehicle. Similar to the above, Central Sales tax is a levy on sale of commodities produced outside a state. This is currently charged at 4%.

Suggested interventions

Based on the discussion above, and the review of market based instruments in the transport sector in India and elsewhere, two interventions are being suggested. The first is a framework for vehicle taxation that would reflect the environmental implications of vehicles, and second, a tradable permits regime to encourage automobile manufacturers to move to cleaner technologies before the mandated date.

Vehicles

In this section, a framework for modifications in the existing tax structure of vehicles to be based on the emissions of the vehicles is suggested. The guiding principle in this strategy is to adjust the existing structure of the sales tax, excise duty, the special excise duty and central sales tax levied on vehicles, so as to reflect the total emissions loading of a vehicle within a particular mode. Hence, the taxes on more polluting vehicles should be increased while those on less polluting vehicles should be reduced. This would ensure that the polluter pay principle holds, thus the vehicles that pollute more are made to pay higher for the cost they impose on the environment by way of emissions while those which pollute less will be made to pay lower.

However, adjustments in the tax structure should be made keeping in view rationalisation of the tax regime as described in Chapter 2. Over the years the tax structure has been rationalised in the country. The number of excise tax slabs has been reduced to from 11 in the pre-1999 period to a uniform Cenvat of 16%. Also the Special Excise duty rate has been reduced to single rate of 16%. The Union Budget of 2002/03 has also not brought about any changes in this tax structure.

Thus the suggested principle is the following:

- Lower the taxes on less polluting vehicles
- Raise the taxes on more polluting vehicles
- Adjust taxes in accordance with rationalisation of taxes.

In order to achieve this, vehicles should be placed in a particular tax bracket depending upon the level they pollute. For instance, if there are 3 levels of emission norms Euro I, II and III, then the vehicles which comply with Euro III norms should be placed in the lowest tax bracket, vehicles which adhere to Euro II norms should be placed in the intermediate tax bracket and the Euro I vehicles should be placed in the highest tax bracket. This tax structure should be time bound. Once all the vehicles produced in the country comply with Euro II norms, the Euro II vehicles should be moved to highest tax bracket, Euro III to the intermediate tax bracket and so on.

The objective of the exercise should be that the tax liability reflects the environmental impact of the vehicles. However, the aim should not be to introduce any price distortions in vehicles by influencing the total market price, which reflects the production cost, profit margins and taxes. The purpose should be that the relative tax liability of each vehicle should reflect its relative external cost.

This framework is illustrated through a case study of Delhi in Annex 3.3.

A tradable permits system

As described in Chapter 2, the current pollution control policy in the transport sector relies on the setting norms for emissions that are to be universally adhered to by all vehicles that are sold in the country. These in turn are based on the available vehicle technology and the potential for improvement. However, what the norms prescribe is the maximum allowable emissions per vehicle based on the total desirable emissions from the transport sector. Thus, the emissions norms are the average emissions from each vehicle to ensure that the total emissions from all vehicles do not exceed a maximum.

Currently emission norms are set on the basis of the average expected emissions per vehicles to maintain a global maximum. Here, the efficiencies that would arise from a cheaper abatement technology in some vehicles that would allow higher emissions from other vehicles with more expensive abatement technology, while still maintaining the overall average, are lost. As described in Chapter 2, a tradable permits regime would facilitate a least cost outcome to meet specific air quality or total emissions level. These would also provide incentives for manufacturers to produce cleaner vehicles so as to reduce the dependence on other manufacturers to obtain these rights to continue production, or to obtain the benefit from selling these rights.

This section describes a tradable permits regime for the automobile sector. Annex 3.6 suggests the proposed tradable emission rights regime. Annex 3.7

illustrated the implementation of the regime. This strategy would be an incentive for manufacturers to produce cleaner vehicles faster.

Defining the tradable permit

Tradable permits capture the inherent efficiency gain that is possible by allowing more expensive abatement technologies to emit more and cheaper abatement technologies to emit less, maintaining the desired average emissions. These define property rights for pollution by setting a limit on the total allowable emissions, and then allocating these across all polluters. The polluters are then permitted to trade in these emission limits. As described in Chapter 2, this has been used successfully in the US to phase out lead in gasoline.

In the transport sector, tradable permits could be defined as the emission rights for various vehicles. These could then result in trade between various automobile manufacturers by allowing manufacturers that produce less polluting vehicles to sell their unused emission rights to manufacturers that produce vehicles that emit more. The emission rights could be defined for each pollutant and on the basis of the emission norms, that is in grams per kilometre or kwh. Hence, the manufacturers producing a more polluting vehicle would have to purchase a permit for each pollutant specified in the emission norms for each vehicle that is sold. In case any manufacturer is unable to either purchase the emission permit, or manufacture vehicles that meet the standard, he would not be able to sell his vehicle.

Design issues

The design of the tradable permit regime would be critical for ensuring that the desired outcomes of promoting cleaner technologies in a least cost manner are realised. It is also critical that the tradable permits regime is effectively targeted Here it is essential that the trade and purchase of a tradable permit is contingent on the sale of a vehicle, and not its production. Thus, a firm producing a less polluting vehicle would be able to sell its emission rights only if it sells the vehicles, not just produces it.

Secondly, it is important to limit the possibility of trade within each mode. This is important since the emission rights have been defined in grams of each pollutant per km or kwh, and if trade is permitted between different modes, with different travel characteristics, the desired outcome of maintaining the total emissions will not be attained. For instance, in case of trade were permitted between a bus and a car manufacturer, even if the emissions per km are not exceeded, the total emissions in a lifetime for each vehicle type would exceed as a bus travels far more than a car. Here again, this could be further limited to a fuel technology option, such as only within CNG cars, so that emissions of any one pollutant are not exceeded. However, this may imply that trade would not take place in vehicle categories where manufacturers are not able to meet the standards. For instance, if all two wheeler manufacturers are not able to meet the standard, trade would not be possible.

Also, it is important to avoid the concentration of more polluting vehicles in a hotspot. This can be avoided by restricting the trade in permits to within a geographical. Since a majority of the sale of vehicles takes place in urban areas[a], restricting the trade in permits to within a state would ensure that more polluting vehicles are not concentrated within an area.

Finally, the emission norms are stagnant for period they are valid. For instance, as per the suggested improvement in norms, the emission standards for Delhi would remain at the BS II till 2007. Through a tradable permits regime, a gradual improvement can be effected. This can be done by reducing the tradable emission rights of each manufacturer for each vehicle periodically to encourage continuous improvement in technology. In addition, the credits should be available only for a specific time period. Carry-forward of credits should not be allowed.

Implementation issues

Since the tradable permits regime that is being suggested here is for automobile manufacturers, the Ministry of Heavy Industries, Government of India, could be the implementing agency. Thus the permits would need to be registered with the Ministry of Heavy Industries and the trade would take place only on their verification of the sale of each type of vehicle. The certifying agencies for the emissions could be the same that carry out the Conformity of Production tests for vehicles under the Motor Vehicles Act 1988, namely Automotive Research Association of India, and Vehicle Research Development and Establishment.

However, the implementation of such a scheme would require an amendment in the Motor Vehicles Act 1988 to allow automobile manufacturers to sell vehicles that emit more than the prescribed norm once they have purchased the permits to emissions.

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[a] The 23 metropolitan cities account for about 30% of the total number of vehicles registered (MoST 2000)

Annex 3.1 Price build up of various vehicles

Category	Ex-factory price	CST	Sales tax	Excise duty	SED	Price
Two wheelers						
2-stroke Bharat 2000	15965	639	2311	2657	0	2157
2-stroke Bharat 2005	19465	779	2818	3239	0	2630
4-stroke Bharat 2000	23860	954	3454	3970	0	3223
4-stroke Bharat 2005	28860	1154	4178	4802	0	3899
Three wheelers						
Gasoline Bharat 2000	52240	2090	7563	8693	0	7058
Gasoline Bharat 2005	57490	2300	8323	9566	0	7767
CNG Bharat 2000	67080	2683	9711	11162	0	9063
CNG Bharat 2005	72330	2893	10471	12036	0	9773
Private cars						
Gasoline Bharat I	172110	6884	28639	28639	28353	26462
Gasoline Bharat II	202247	8090	33654	33654	33317	31096
Gasoline Bharat III	222505	8900	37025	37025	36655	34210
Diesel Bharat I	280233	11209	46631	46631	46164	43086
Diesel Bharat II	310370	12415	51646	51646	51129	47720
Diesel Bharat III	330628	13225	55016	55016	54466	50835
CNG Bharat II	268833	10753	44734	44734	44286	41334
CNG Bharat III	280833	11233	46731	46731	46263	43179
Buses						
Diesel Bharat I	529604	21184	88126	0	76670	71558
Diesel Bharat II	591470	23659	98421	0	85626	79917
Diesel Bharat III	649708	25988	108111	0	94057	87786
CNG Bharat II	870000	34800	144768	0	125948	117551
Heavy commercial vehicles						
Bharat I	715000	28600	118976	0	103509	96608
Bharat II	776866	31075	129271	0	112465	104967
Bharat III	877148	35086	145957	0	126983	118517

Annex 3.2 Cost Implications of increasing automobile standards according to manufacturers

In this section the technologies required for up gradation from Bharat stage II (BS II) to Bharat stage III (BS III) have been identified and the approximate incremental cost for each vehicle type based on personal interviews with automobile manufacturers have been estimated. These estimates on incremental costs have been collated from a number of manufacturers and need to be validated again. In addition, some of these technologies, such as variable exhaust gas recirculation and variable geometry turbocharger, would need to be imported, thus increasing the uncertainty in the capital costs.

Two wheelers

The future emission norms being reported by the manufacturers are shown in Table below. In the two and three wheeler segments, Bharat Stage II is not prescribed and the emission norms would increase from the current India 2000 to Bharat Stage III.

Norms for two wheeler

Standards	CO (g/km)	HC+Nox (g/km)
India 2000	2.0	2.0
India 2005	1.5	1.5

Source: Mr. N V Iyer, Bajaj Auto, 12th February 2002

The emission norms for two and three-wheelers in India are fairly stringent compared to Europe and US. This is due to the phenomenally high penetration level of two wheeler segment in India. It needs to be highlighted that apprehensions were raised by the two wheeler manufacturers that in case the new auto fuel policy proposes with norms that are more stringent than the above norms, the industry has raised apprehensions to meet these norms along with the deterioration factor and with type approval equal to the conformity of production. But, given the penetration level and the subsequent emissions from the two wheelers there is need for more stringent norms in the future.

The technology and the approximate cost required for meeting the norms as mentioned by the manufacturer of 2 stroke and 4 stroke two wheelers are given in Table below.

Technology and cost implication for up gradation to BS III

Technology	2-W Two Stroke	4-W Two Stroke
Secondary air injection	Rs 1000 per vehicle	Rs.1500 per vehicle
Catalyst converter	Rs.1500 per vehicle	Rs.2500 per vehicle

Source: Mr. N.V. Iyer, Bajaj Auto as on 12the February 2002

Apart from the above cost, capital investment on development as given by the manufacturer will be approximately Rs 10 million per vehicle platform. This translates into Rs 1000 per vehicle. In all, the incremental cost for two-stroke two wheeler vehicles will be around Rs 3500 per vehicle and for four stroke two wheeler will be around Rs 5000 per vehicle. A comparison of price of India 2000 and BS III two wheeler is shown in the Table below.

Comparison of Ex-factory prices of Two Wheelers

Rs per vehicle	India 2000	BS III	Increase
2 Stroke	Rs.15965	Rs 19465	22%
4 Stroke	Rs 23860	Rs 28860	21%

Three wheelers

The future emission norms expected for three wheelers are given in Table below.

Norms for three wheelers

Standard	CO (g/km)	HC+NOx (g/km)
India 2000	4.00	3.00
India 2005	2.25	2.00

Source: Mr.N V Iyer, Bajaj Auto, 12th February 2002

The technologies and approximate cost that are required to meet the above norms as given by the manufacturers are shown in Table 3.10.

Technology and cost implication for up gradation to BS III

Technology	Three Wheeler
Secondary air injection	Rs. 1500 per vehicle
Catalyst converter	Rs 2500 per vehicle

Source: Mr. N Y Iyer, Bajaj Auto, 12th Feb 2002

Apart from the above cost, capital investment on plant and technology as reported by the manufacturers will be approximately Rs 15 million per vehicle platform, which is around Rs 1500 per vehicle. Hence the incremental cost for three wheeler vehicles will be Rs.5250 per vehicle.

A comparison of price of India 2000 and BS III three wheelers is shown in the Table below.

Comparison of Ex-factory prices of Three Wheelers

Rs per vehicle	India 2000	BS III	Increase
4 Stroke	Rs.52240	Rs.57490	10%
CNG	Rs.67080	Rs.72330	8%

Passenger cars

The BS II and BS III emission norms for passenger cars are summarised in Table below.

Emission norms for passenger cars

Standards	CO (g/km)	HC+NOx (g/km)	PM (g/km)
BS II Gasoline	2.20	0.50	
BS II Diesel	1.00	0.70	0.08
BS III Gasoline	2.20	-	
BS III Diesel	0.64	0.56	0.05

Source: Mashelkar Committee 2002

The different technologies and cost for upgradation to BS II and BS III norms based on interviews with some manufacturers are summarised in Table below.

Technology and cost implication for up gradation to BS II and BS III compliant passenger cars

4-Wheeler		Cost (Rs. Per vehicle)	
Euro II/ BS II	Technology	Indigenous	Imported
	Fuel Injection	NA	15000
	Catalytic Converter	5000	NA
	Fixed Exhaust Gas Re-Circulation	400	1200
	CNG/LPG	NA	8000
Euro III / BS III	Fuel injection + Catalytic Converter	NA	26000
	Variable Exhaust Gas Re-circulation	NA	2500
	Multi-Valve	7000	NA
	CNG/LPG	NA	12000

Source: Mr V. Krishnan, TELCO, 13th February, 2002.

Apart from the above cost, capital investment for up gradation of technology to BS II as reported by the manufacturers will be approximately Rs 90 million for a firm producing around 50000 passenger cars in a year. Thus the capital cost would be Rs 1737 per vehicle resulting in a net incremental cost of Rs 30137 per vehicle.

Similarly the capital cost for up gradation to BS III as reported by the manufacturers will be approximately Rs 150 million. Capital cost, if loaded into a single vehicle, will be Rs 2895 per vehicle. Accordingly the incremental cost for BS III compliant passenger cars would be Rs 50395 per vehicle. Comparison of ex-factory prices of BS I, BS II, and BS III passenger cars is shown in the Table below.

Comparison of Ex-factory prices of Passenger Cars

Rs per vehicle	BS I	BS II	Increase	BS III	Increase
Petrol	172110	202247	18%	222505	29%
HSD	280233	310370	11%	330628	18%
CNG	NA	268833	NA	280833	NA

Buses and trucks

The proposed BS II and BS III emission norms for Heavy Vehicles are summarised in Table 3.15.

Emissions Norms for HCV

Standard	CO (g/kWh)	HC (g/kWh)	NOx (g/kWh)	PM (g/kWh)
Euro II	4.0	1.1	7.0	0.15
Euro III	2.1	0 66	5.0	0.10

Source Mashelkar Committee 2002

The different technologies and cost for up gradation to BS II and BS III norms as given by manufacturers are listed in Table 3.16.

Technology and cost implication for up gradation to BS II and BS III compliant vehicles

Standard	Technology	Cost (Rs Per vehicle)	
		Indigenous	Imported
Euro II/ BS II	Turbo charging	Rs 12000	Rs 25000
	Injection pressure > 800 bar, moderate swirl	Fuel Injection pump- Rs 25000 Cylinder head modification- Rs 700	NA
	VO nozzles	Rs 1600 per injector	NA

	Re-entrant combustion control	Rs.500 per piston	NA
	Lub oil consumption control	Rs 4000 per engine	NA
	Inter-cooling (optional depends on specific power)	Rs 7500 per engine	26000
	Exhaust Gas Re-circulation	Rs 2500	4000
	Conversion to CNG, Catalytic converter	@Rs. 100000 for light vehicles @ Rs.750000 for bus CNG Cat Converter - Rs.5000	NA
Euro III/ BS III	Multi-Valve	Rs.17500	NA
	Rotary pumps, pilot injection rate shaping	Rs.60000	Rs.75000
	Critical Lub oil consumption control	Rs.4500	NA
	Variable geometry turbocharger	NA	Rs.30000
	Inter-Cooling	Rs.7500	NA
	Oxycatalyst & EGR	Rs.7500, Rs.5000	NA
	CNG/LPG injection	@Rs. 100000 for light vehicles @ Rs.750000 for bus CNG	-

Source: Mr. V Krishnan, TELCO, 13th February 2002

Apart from the above, capital investment for up gradation of technology to BS II as reported by the manufacturers will be approximately Rs 300 million for a firm producing around 90000 vehicles in a year, which is around Rs 3066 per vehicle. Hence the incremental cost for BS II compliant Buses and trucks would be Rs 61866 per vehicle.

Similarly, the capital cost for up gradation of technology to BS III as reported by the manufacturer will be approximately Rs 2.95 billion. Capital cost if loaded into a single vehicle will be Rs 30148 per vehicle. Accordingly the incremental cost for BS III compliant buses and trucks would be Rs 162148 per vehicle.

Comparison of Ex-factory prices of HVCs

Rs per vehicle	BS I	BS II	Percentage increase	BS III	Percentage increase
Trucks	715000	776866	9%	877148	23%

Annex 3.3 Vehicle taxation: A case study of Delhi

The first step was to establish an environment and tax ranking. Based on the emissions on a per kilometre basis for a vehicle, an ordinal ranking was established for the vehicles within each mode. Similarly, based on the tax liability for each vehicle, an ordinal ranking was established for vehicles within each mode. The environmental ranking was then compared with the tax ranking of the vehicles. Then adjustments in the tax structure were made so as to achieve rankings in the tax liability similar to those in the emission loading within each mode. Thus, taxes on polluting technology within each mode were raised, while those on less polluting were lowered.

Emission ranking

To estimate emission rankings, the emissions per kilometre for each vehicle were estimated. To aggregate the emissions of different pollutants, weights can be assigned to the different pollutants. For example, in this illustration, for aggregating the emissions, the level of environmental severity for each pollutant was established. This was approximated using the toxicity weights and the degree to which each pollutant exceeds or is less than its National Ambient Air Quality Standard. In absence of appropriate toxicity weights of different pollutants for the Indian context, the 1992 World Bank data (Air quality management: considerations for developing countries, The World Bank Technical Paper No.278 Energy Series) on the approximate toxicity weighting factors of pollutants were used. Also the NAAQS (1994) were compared with the annual average ambient air quality reported at a busy traffic intersection in Delhi, ITO, to establish the degree to which a pollutant exceeds or falls short of the standards. The index so calculated reflects the desirability to reduce pollutants in the city so as to achieve the legislated ambient air quality standards. Only those pollutants that are currently regulated in the automobile sector were considered that is HC, CO, NOx, and RSPM. It may be noted that SO2 was not considered, as it is not regulated in the automobile sector although it is in the oil sector in terms of sulphur content in HSD and MS The detailed estimation procedure for the Emissions Severity Index is given in the Table below.

Emission Severity Index of the pollutants

Pollutant	Annual average Ambient air quality (1998) µg/m³	NAAQS (µg/m³)	Degree in excess of desirable standards	Toxicity weights	Emission Severity Index
CO	5450 00	2000.00	273	0 04	0 11
HC*			94	1 80	1.70
Nox	63.00	60.00	105	4.70	4.94
RSPM	210 08	60 00	350	2.30	8.05

* Since there are no NAAQS for HC, though it is one of the regulated pollutants in the automobile sector, the degree to which it exceeds its desirable standard was approximated using the NAAQS for CO and the proportion of the total emissions loading of CO and HC estimated in Bose 2000

Source. MoEF, 2000, World Bank, 1995

It must be noted that the emission factors of a particular vehicle depends upon its technology, after treatment devices that are used to reduce the tailpipe emissions, and the fuel efficiency. Hence a better technology vehicle will emit less pollutants not only on account of improvement in technology and after treatment devices but also as a result of lower quantities of fuel consumed. In this case study, emission factors from Transport Fuel Quality for Year 2005, published by Central Pollution Control Board, were used for the analysis.

Using the emission factors for each pollutant for each mode and the Emission Severity Index of each pollutant, the emissions for each vehicle were estimated. These are given in the Annex 3.4.

Each vehicle was ranked according to its emissions within its mode. For this, the emissions of each vehicle on each fuel is compared within the same mode and ranked accordingly (Table in page 46). For instance, within three wheelers, gasoline three wheelers Bharat 2000 have the highest emissions followed by Bharat 2005 gasoline, Bharat 2000 CNG and Bharat 2005 CNG three wheelers respectively. Accordingly the gasoline Bharat 2000 and Bharat 2005 three wheeler are given a rank of one and two, CNG Bharat 2000 three wheeler is ranked third, and CNG Bharat 2005 is at four.

Tax ranking

The tax ranking for vehicles in each mode was calculated in a manner similar to the emission ranking. The first step was estimating the tax liability of each vehicle. This was arrived at by taking into account the sales tax, excise duty special excise duty (SED) and Central Sales tax (CST). The tax liability for each is given in Annex 3.5.

The tax liability of the vehicle was compared within the mode and ranked accordingly. For instance, within three wheelers, gasoline three wheelers Bharat 2000 have the lowest tax liability followed by Bharat 2005 gasoline, Bharat 2000 CNG and Bharat 2005 CNG three wheelers respectively. Accordingly the CNG Bharat 2005 three wheeler is ranked first, CNG Bharat 2000 is given a rank of two, gasoline Bharat 2000 is at three and the gasoline Bharat 2005 ranked fourth.

The mode-wise environmental and tax ranking of vehicles is given in Table below.

Environmental and Tax ranking of vehicles

Category	Env Ranking	Tax Ranking
Two wheelers		
2 stroke India 2000	1	4
2 stroke India 2005	4	3
4 stroke India 2000	2	2
4 stroke India 2005	3	1
Three wheelers		
Gasoline India 2000	1	4
Gasoline India 2005	2	3
CNG India 2000	3	2
CNG India 2005	4	1
Private cars		
Gasoline Bharat I	1	8
Gasoline Bharat II	5	7
Gasoline Bharat III	6	6
Diesel Bharat I	2	4
Diesel Bharat II	3	2
Diesel Bharat III	4	1
CNG Bharat II	7	5
CNG Bharat III	8	3
Buses		
Diesel Bharat I	1	4
Diesel Bharat II	2	3
Diesel Bharat III	3	2
CNG Bharat II	4	1
Heavy commercial vehicles		
Bharat I	1	3
Bharat II	2	2
Bharat III	3	1

Optimising the tax structure

To optimise the tax structure for vehicles considered in this case study, the optimum tax rate for each vehicle in a given mode was calculated such that the proposed sales, excise duty, special excise duty and CST structure reflected the environmental ranking. This was done by adjusting the existing tax levels within the existing tax slabs so as to achieve a ranking similar to the environmental ranking. The adjustments in the tax structure were made keeping in view rationalisation of the tax regime. The principle which is followed in this case study is that within each mode, for the vehicle with the highest environmental ranking, a SED of 24% is imposed, the excise duty remains at 16% and CST remains at 4%. However, in case of buses and HCVs, a 16% SED is imposed instead of 24% as these vehicles can have a larger inflationary impact on the economy For vehicles that were less polluting, the SED and/or excise duty and/or CST is reduced to 0. For the least polluting vehicles, the excise duty, SED and CST is reduced to 0. In case of the modes where there is a necessity to further adjust the tax structure, the sales tax is increased to 20% for the most polluting vehicle, for the successive environmental ranking the proposed sales tax is 12%, 8% and 0% for the vehicle with the lowest ranking.

The objective is be that the tax liability reflects the external costs. The aim should not be to affect the total market price of the vehicles, as these are a function of the production cost, profit margin and taxes. If an attempt to change prices to reflect the environmental ranking is made, then the tax adjustments that would be required would be very substantial in some cases. For example, in case of buses, the ex-factory price differential between CNG Bharat II and diesel Bharat II bus is around Rs.2, 78,500. In order to equalise just the ex-factory price, a tax of over 45% will have to be imposed on the CNG Bharat II bus.

However, in this case study as a result of the suggested taxes the price of the better technology vehicle in most of the modes is coming out to be lower than the less improved technology vehicle. For instance, the price of CNG Bharat stage III three wheeler would work out to be Rs 5000 less than the price of CNG Bharat stage II three wheeler. This would have dual benefit of covering the incremental cost that a manufacturer will have to incur for producing a better technology as well as persuade the price sensitive consumers to go in for better technology vehicle. The proposed tax structure is shown in the Table below.

Proposed changes in tax structure for vehicles

Category	Sales tax	Excise tax	SED	CST
Two wheelers				
2-stroke Bharat 2000	20%	16%	24%	4%
2-stroke Bharat 2005	12%	0%	0%	0%
4-stroke Bharat 2000	20%	16%	0%	4%
4-stroke Bharat 2005	12%	0%	0%	0%
Three wheelers				
Gasoline Bharat 2000	20%	16%	24%	4%

Gasoline Bharat 2005	12%	16%	0%	0%
CNG Bharat 2005	12%	0%	0%	4%
CNG Bharat 2005	0%	0%	0%	0%
Private cars				
Gasoline Bharat I	20%	16%	24%	4%
Gasoline Bharat II	12%	16%	0%	4%
Gasoline Bharat III	8%	0%	0%	0%
Diesel Bharat I	12%	16%	0%	4%
Diesel Bharat II	8%	16%	0%	4%
Diesel Bharat III	8%	16%	0%	0%
CNG Bharat II	0%	0%	0%	4%
CNG Bharat III	0%	0%	0%	0%
Buses				
Diesel Bharat I	20%	16%	16%	4%
Diesel Bharat II	20%	16%	0%	4%
Diesel Bharat III	12%	16%	0%	0%
CNG Bharat II	0%	0%	0%	0%
Heavy commercial vehicles				
Bharat I	20%	16%	16%	4%
Bharat II	12%	16%	0%	4%
Bharat III	0%	0%	0%	0%

Revenue Implications

The revenue impact for this year of the proposed tax structure has been calculated based on the sales of vehicles in 2001/02. Some assumptions have been made for category wise sales number in absence of published data on the same. For instance, in case of two wheelers, scooters and mopeds taken as two stroke and motor cycles are taken as four stroke two wheelers. For rest of the modes, the sales figures were taken based on the market share of Bharat stage I and II.

Since the proposed tax structure raises the sales tax for more polluting vehicles while lowers that tax for less polluting vehicles, the impact for the State Government for based on the current year sales is likely to be revenue generating. Similarly, imposition of special excise duty is proposed on more polluting vehicles across all modes while the excise duty is reduced for less polluting vehicles, and the impact this year is likely to be revenue generating for the Central Government. However, the estimate of revenue impact is based on the sales, the impact will vary depending on the sales figure for various vehicles.

Thus these numbers are indicative and would need to be assessed on an annual basis.

Revenue impact of the proposed tax structure

Category	Sales	Revenue gain (in billions)	
		Excise + SED+CST	Sales tax
2 wheelers	5011316	6.2	10.57
3 wheelers	240736	2.38	1.49
Cars	696255	-10.96	3.36
Buses	29289	1.24	1.06
HCVs	59467	5.85	4.54
Total	6037063	4.70	21.02

Annex 3.4 Emissions in grams/km

Category	CO	HC	NOx	RSPM	Emissions	Env Ranking
Two wheelers						
2 stroke India 2000	2.20	2.13	0.07	0.05	4.60	1
2 stroke India 2005	1.40	1.32	0.08	0.05	3.19	4
4 stroke India 2000	2.20	0.70	0.30	0.05	3.31	2
4 stroke India 2005	1.40	0.70	0.30	0.05	3.22	3
Three wheelers						
Gasoline India 2000	4.30	0.67	0.47	0.08	4.58	1
Gasoline India 2005	2.45	0.09	0.45	0.08	3.28	2
CNG India 2000	1.23	0.03	0.09	0.00	0.61	3
CNG India 2005	0.70	0.01	0.10	0.00	0.57	4
Private cars						
Gasoline Bharat I	3.90	0.80	1.10	0.05	7.61	1
Gasoline Bharat II	1.98	0.25	0.20	0.03	1.87	5
Gasoline Bharat III	1.39	0.15	0.12	0.02	1.16	6
Diesel Bharat I	1.20	0.37	0.69	0.42	7.55	2
Diesel Bharat II	0.90	0.13	0.50	0.07	3.35	3
Diesel Bharat III	0.58	0.05	0.45	0.05	2.77	4
CNG Bharat II	0.11	0.16	0.13	0.00	0.94	7
CNG Bharat III	0.08	0.10	0.08	0.00	0.56	8
Buses						
Diesel Bharat I	4.5	1.21	16.8	1.60	98.34	1
Diesel Bharat II	3.60	0.87	12.0	0.56	65.60	2
Diesel Bharat III	3.20	0.87	11.0	0.24	58.04	3
CNG Bharat II	1.58	0.39	5.28	0.08	27.52	4
CNG Bharat III	1.41	0.39	4.84	0.03	24.97	5
Heavy commercial vehicles						
Bharat I	4.50	1.21	8.40	0.80	50.44	1
Bharat II	3.60	0.87	6.30	0.28	35.21	2
Bharat III	3.20	0.87	5.50	0.12	29.93	3
Emission Severity Index	0.11	1.70	4.94	8.05		

Source. CPCB 2000, Reddy 2001, AUTO India 1999

Annex 3.5 The existing price and tax structure

Category	Sales tax	Excise duty	SED	CST	Tax liability (Rs)
Two wheelers					
2-stroke Bharat 2000	12%	16%	0%	4%	21571
2-stroke Bharat 2005	12%	16%	0%	4%	26300
4-stroke Bharat 2000	12%	16%	0%	4%	32239
4-stroke Bharat 2005	12%	16%	0%	4%	38995
Three wheelers					
Gasoline Bharat 2000	12%	16%	0%	4%	70585
Gasoline Bharat 2005	12%	16%	0%	4%	77679
CNG Bharat 2000	12%	16%	0%	4%	90636
CNG Bharat 2005	12%	16%	0%	4%	97730
Private cars					
Gasoline Bharat I	12%	16%	16%	4%	264625
Gasoline Bharat II	12%	16%	16%	4%	310962
Gasoline Bharat III	12%	16%	16%	4%	342109
Diesel Bharat I	12%	16%	16%	4%	430868
Diesel Bharat II	12%	16%	16%	4%	477205
Diesel Bharat III	12%	16%	16%	4%	508352
CNG Bharat II	12%	16%	16%	4%	413340
CNG Bharat III	12%	16%	16%	4%	431791
Buses					
Diesel Bharat I	12%	16%	0%	4%	715584
Diesel Bharat II	12%	16%	0%	4%	799175
Diesel Bharat III	12%	16%	0%	4%	877865
CNG Bharat II	12%	16%	0%	4%	1175516
CNG Bharat III	12%	16%	0%	4%	2155113
Heavy commercial vehicles					
Bharat I	12%	16%	0%	4%	966085
Bharat II	12%	16%	0%	4%	1049676
Bharat III	12%	16%	0%	4%	1185174

Source. www cbec gov in, www delhisalestax.com

Annex 3.6

Current and proposed emission norms

	2 Wheelers		3 Wheelers		Gasoline cars		Diesel cars			HCVs		
NORMS			petrol							GM/KWH		
	CO	HC+Nox	CO	HC+Nox	CO	HC+Nox	CO	HC+NOX	PM	CO	HC+Nox	Nox
Y2K	2.00	2.00	4.00	3 00	2.72	0.97	2 72	0.97	0 14	4 5	1 10	8
BS II					2 2	0 50	1 0	0.70	0 08	4	1.1	7
BS III	1.50	1 50	2 25	2 00	2.2	0 50	0 64	0 56	0 05	2 1	0 7	5

Tradable permits regime

Tradable emission norm	2 Wheelers		3 Wheelers		Gasoline cars		Diesel cars			HCVs			
	CO	HC+Nox	CO	HC+Nox	CO	HC+Nox	CO	HC+NOX	PM	CO	HC+Nox	Nox	PM
2000	2.00	2 00	4.00	3 00	2 72	0 97	2 72	0 97	0 14	4 50	1 10	8 00	0 36
2001	1.93	1 93	3 75	2.86	2 62	0 88	2 38	0 92	0 13	4 40	1.10	7 80	0 32
2002	1 86	1 86	3.50	2 71	2 51	0 78	2 03	0 86	0 12	4 30	1 10	7 60	0 28
2003	1.79	1.79	3 25	2 57	2 41	0 69	1 69	0 81	0 10	4 20	1.10	7 40	0 23
2004	1.71	1.71	3 00	2 43	2.30	0.59	1.34	0 75	0 09	4 10	1 10	7 20	0 19
2005	1.64	1 64	2.75	2 29	2 20	0 50	1 00	0 70	0 08	4 00	1.10	7 00	0 15
2006	1 57	1 57	2.50	2.14	2 20	0.50	0.82	0 63	0 07	3 05	0 88	6 00	0 13
2007	1 50	1 50	2.25	2 00	2.20	0 50	0 64	0 56	0 05	2 10	0 66	5 00	0 10

Annex 3.7 Tradable permits regime: an illustration

The tradable permits regime suggested in this section is illustrated using an assumed emission standard of 10 unit of the pollutant per kilometre of travel, that reduces to 5 over time. Then in case of a tradable permits regime, to promote a gradual improvement in technology, a tradable permits standard can be designed based on a gradual improvement in the standard, from 10 to 5 as given in Table 3.22.

In an economy with two firms, one of which can meet the standard, and one that cannot, a trade in emissions per vehicle can take place as illustrated. Firm II can produce less polluting vehicles and thus has unused emission rights, which can be bought by Firm I for each vehicle that it would sell. As the emission rights for each firm would reduce over time to the future mandated standard, each firm would have to meet increasingly stringent standards. Thus both firms would have incentive to innovate. Firm I would need to innovate to meet the increasingly stringent standard as also to reduce its revenue outflow on account of the purchase of emission rights. Firm II would also need to innovate to continue to retain its competitive edge in the market. However, as the abatement technology in Firm I is more expensive, it would allow the market to exploit the cost minimising potential and thus achieve the same desired outcome at a lower cost.

Tradable permits: an illustration

	Standard	Tradable Permit Standard	Firm I	Firm II	Trade
2000	10	10	12	7	2
2001	10	9	11	7	2
2002	10	8	10	6	2
2003	10	7	9	5	2
2004	10	6	6	5	0
2005	5	5	5	5	0

4

Alternate Fuels Tax Structure

The tax on a fuel is a major component of the fuel price. This relative price of fuels influences the choice of the consumer. Taxation as an instrument of facilitating choice of the fuel use has been used for many countries. Fuel taxes should also have built in them their environmental impact so that consumers are discouraged to chose a fuel that has a deteriorating environmental impact. The focus of this chapter is to build tax structures of fuels based on their environmental impact.

Only those fuels, which have been pointed out in the Auto Fuel Policy, have been considered in this chapter.

The chapter has been divided into the following sections:

- Current duty and tax structure of fuels in India
- Roadmap of duty structure
- Post APM scenario for Auto Fuels
- Need for incentives for cleaner technologies
- Review of international mechanisms used for promoting clean fuels
- Options for incentive mechanisms for clean fuels
- Issues related to taxation of fuels
- Proposed pricing structure of auto fuels.
- Ranking of options recommended

Current duty and tax structure of fuels in India

The current petroleum product prices are based on the administered price mechanism (APM) where MS (motor spirit/gasoline/petrol) cross-subsidizes the lower price of Kerosene and LPG.

The current duty and tax-structure for crude and the major auto fuels is given in the table below:

Table 4.1. Current Customs and Excise Duties (effective till March 31st, 2002)

Item	Customs Duty (%)	Excise Duty (%)
Crude	10	NA
HSD	20	32[a]
MS	20	90
Kerosene (PDS)	5	16
Kerosene (Parallel Marketing)	35	16
LPG (domestic)	10	8
LPG (Parallel Marketing)	10	8
LNG / Natural Gas	5	8

The current duties have been changed after the General Budget 2002/03 as part of the overall strategy of moving towards deregulation and dismantling of the APM structure of marketing the controlled products, namely, LPG, MS, HSD and Kerosene. All the other petroleum products are already decontrolled.

Roadmap for Duty Structure

The Expert Technical Group (MoPNG 1997) first recommended the tax structure of petroleum products in the post APM period. The various proposals made in this regard are summarized in table 4.2.

Table 4.2. Projected duty structure of important petroleum products(10)

Item	Customs Duty (%) Hydrocarbon Vision 2025	Excise Duty	
		Expert Tech Group 1997	Hydrocarbon Vision 2025
Crude	5		
HSD	15	15[b]	16
MS	15	165	32
Kerosene	0	10	10
LPG	8	8	
LNG / Natural Gas	5	8	

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[a] These duties have been temporarily changed to 90 % and 32 % till Feb 28th, 2002 They will be changed to 32 % with an additional surcharge of Rs 6/lt for MS and 32 % for HSD as announced in the Budget proposals of 2002/03 Auto CNG excise duty has been increased to 16 % The excise duty on LPG and auto CNG has been increased to 16 % The customs duty on Kerosene for parallel market has been changed to 20 %

[b] The excise duties have been rationalized to 16 %, 32 % in the Budget 2001-02 and 2002-03 and the customs duty on crude is unchanged at 10 % and that of HSD and MS at 20 %

The excise duty of 165 % on MS proposed by the ETG (MoPNG 1997) included a surcharge, which was supposed to meet the subsidy on SKO and LPG. The Hydrocarbon Vision 2025 (MoPNG 1999) pointed out that such high rates of excise may not be consistent with a rational excise tariff. The levels that were proposed by the Hydrocarbon Vision 2025 were 32 % for MS and 16 % for HSD in the post APM scenario.

It is clear that the subsidy on SKO (PDS) and LPG (domestic) being financed only by additional excise duties on MS will widen the gap between HSD / MS prices and no reduction in adulteration and continued penetration of diesel in most segments of the transport sector. There is need to rationalize the taxation across all fuels namely, Kerosene, Naphtha etc as their continued lower prices would help in the diversion of fuels towards adulteration of the transport fuels. In this connection there is also a projected roadmap of removal of the subsidies on Kerosene and LPG for domestic use. The subsidies would be completely removed in a phased manner in 3 years time starting from April 1st, 2002. This would help in balancing the prices of all fuels and reducing diversions of these fuels.

Post APM scenario for Auto Fuels

The expected post APM scenario on pricing and marketing of auto fuels is summarized in this section.

Product distribution

Under the present system, distribution of controlled products is co-ordinated by the Oil Co-ordination Committee (OCC). The monthly Supply Plan for controlled products, prepared by the OCC, specifies product movements by rail/road/pipelines / tankers, deliveries and receipts at terminals and depots, etc.

Post deregulation, all marketing companies would have to make their own arrangements for distribution of products. There would also be a regulator appointed by the Ministry of Petroleum and Natural Gas to act as the market regulator.

While the regulator would not have any direct role in product distribution, he will have a critical role to play in terms of tariff fixation for common carrier infrastructure. The policy decision on whether the owner of a pipeline gets first access or not and other related policy decisions in the post APM scenario will have to be covered by the Petroleum Regulatory Bill which will be soon presented.

In addition, the regulator would have to monitor availability of petroleum products and ensure their availability in remote areas of the country.

Decontrol of marketing activities

Under the present system, the location and size of facilities at large volume consumers is subject to Government approvals. In addition, product dealers and retailers are selected through government appointed bodies. In a deregulated environment, public sector marketing companies would have the freedom to decide on their retail networks.

Subsidy on products

Sensitive petroleum products are presently subsidised through the pool accounts. With the dismantling of the APM, cross subsidies on products would be eliminated. Reduced subsidies on domestic fuels (LPG and SKO) would continue for some time but would get transferred to the fiscal budget.

De-regulation of pricing of natural gas

The natural gas price would be brought to 100 % parity based on the basket of fuel oils that are used to calculate the fuel oil price. The current price of natural gas is at 75 % parity linked to the basket of fuel oils but there is a current ceiling price of Rs.2850/thousand cubic meter.

Need for incentives for cleaner technologies based on cost implications

With the same tax structures for fuels of all qualities, there would be an impact on the prices of fuels. Increase in prices of fuels could have a cascading effect on the prices of various commodities.

The impact of increase in prices of fuels along with the improved fuel efficiency has been assessed and is summarized below.

- Rate of inflation based on a weight of 2.2 for diesel in the WPI (Wholesale Price Index). An increase in price of diesel by about Rs.2.5/l would lead to an increase in WPI by about 20 basis points.
- To the extent the movement towards cleaner fuels increases fuel efficiency of the vehicles it which would help in the long term interests of energy conservation and economics of transport. Table 4.4 illustrates the efficiency improvements based on technology improvement.

- Through time limited differential taxation incentives can be provided for introduction of fuels even before the mandated deadlines for implementation.

The effect on inflation in case the cleaner fuel is priced higher than the current quality fuel is given in the table below:

Table 4.3. Impact on inflation

	diesel cost	Petrol cost
%	10%	10%
WPI weight	2 020	0 888
Impact	0 202%	0 093%

The impact as can be seen from the table is not very significant. Therefore, incentives to promote cleaner technologies and fuels would be required so that the transition to cleaner technologies is faster and may be achieved before the mandated deadlines.

Table 4.4. Fuel Efficiency

diesel (Bus)	Km/l
BIS 2000	3.3
Bharat Stage II	3.4
Bharat Stage III	3 57

Review of international experience on promoting clean fuels.

There is a fundamental difference between the patterns of transport fuel use in developing countries like India and developed countries like US. Gasoline being the major transport fuel in developed economies like the US has very stringent specifications. In developing economies, diesel is the dominant fuel, hence movement towards tighter specifications of diesel is very important due to the impact it has on environment and health as far as the use of diesel in the urban transport sector is concerned. This is very similar to the stringent 2-wheeler standards in India when compared to Europe and US, as the population of these vehicles is very high in India when compared to these countries.

There is a fundamental difference in the concerns between the developing and developed countries. The critical issue in the developing countries being the environmental impact in urban areas, there are many global environmental concerns for the developed countries.

The tax as a total percentage of the fuel price in various regions are given below:

Table 4.5. Percentage of tax as part of the Retail Price[2 4]

Country	Petrol % tax	diesel % tax
India	70	58
UK	80	71
US	32	35
Japan	55	42
Canada	48	34
Germany	76	59

1. The detailed price build-up is given in Annexure 1a.

The main policy objectives for fuel taxation internationally are broadly divided into the following:

Revenue raising

Fuel taxation, primarily on motor fuels, has been used to raise revenue. They form a significant portion of the total tax net of most countries. It is observed that the taxation of fuel is seen as providing a stable revenue base because the demand for fuel does not change significantly with short term variations in price. For developing countries fuel taxes comprise a large share of the total tax revenue and this share declines as the GDP per capita rises.

Encourage changes in fuel use

Fuel taxation is sometimes used to encourage changes in fuel use to less polluting or domestically produced fuels. Such policies may reduce revenues to the extent that they cause switching to lower-taxed substitutes. The example of promoting ULSD in UK by having a reduced duty encouraged transition towards ULSD.

Hypothecation

Revenue from some fuel taxes is spent on specific purposes such as road construction. In the United states, all revenue from Federal fuel excise is currently spent on highway construction and many American states, fuel taxes are dedicated, atleast in part, to road construction. In some economies, a portion of taxes on fossil fuels is dedicated to subsidize renewable fuels or to support public transport. In India also, a cess on diesel is imposed, a part of which is used in the development of the Golden Quadrilateral, a 13000-km highway that connects the length and breadth of the country.

Energy Security

Fuel taxation is used as a means to have fuel conservation and a fuel switching effect over a period of time by having differential taxation for imported and indigenous fuels. It is also used as a tool to reduce dependence on particular fuels through using fuels having higher efficiency and use of alternatives. Tax exemptions on ethanol in countries like US are policies with this objective.

Environmental protection

Many developed economies describe fuel taxation as an "environmental tax". Environmental objectives form a part of the taxation build-up in many countries. Taxes can also create incentives for producers or consumers to shift away from environmentally damaging behaviour, thereby reducing the damage. These policies are used to a great extent in European countries where taxation of a fuel is linked to its environmental impact.

In many cases there are reduced tax rates, exemptions and subsidies for cleaner fuels. The fuels, which are by and large categorized as clean fuels, are:

- Low sulphur Petrol and diesel (Bharat Stage II and III and EURO 2005 quality) [a]
- CNG
- LPG
- Ethanol both as a blended fuel and neat fuel.
- Bio-diesel

Details of the various subsidies or exemptions provided for clean alternate fuels, internationally are given in Annexure 4.1 and are summarized here under.

- UK provides for 3-pence/liter-duty cut on Ultra Low Sulphur diesel and 2-pence/liter cut on Ultra Low Sulphur Petrol to encourage refineries to change the facilities to produce the better grades of fuel much before the mandated deadline for producing these fuels which is 2005.
- Hongkong has subsidized diesel with less than 50 ppm Sulphur content by reducing the duty by HK $ 0.89 per liter and this way the price of this grade of diesel works out to be less than the normal diesel.
- Differential taxation exists for fuels of the same category (namely, diesel) but of different standards (namely, Bharat Stage III, EURO IV etc). The

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[a] EURO IV or EURO 2005 fuel (also called Ultra low sulphur diesel and petrol) quality of fuel is not discussed in the Auto Fuel Policy.

effectiveness of this method was tested during the phase out of lead from gasoline also in Germany in late nineties.

- The US provides subsidy on excise for ethanol (54 cents per gallon), both when used as a blend and also as a neat fuel.
- Canada also provides excise exemption on ethanol in fuel blends.
- Bio-diesel in UK is excised at $ 0.28 / liter (approximately Rs.13 /liter) less than normal diesel.
- Low sulphur Petrol and diesel are taxed at the same rate in many EU countries, as there is no policy of discriminating between fuel types of comparable environmental impact and more so as they are meant for different vehicle segments.
- Almost all consumer developed countries have made ethanol excise free (to whatever percentage it is blended in gasoline) to enable it to compete with fossil fuels in terms of prices. This is done to promote cleaner fuel, enhance energy security and to reduce fuel imports.

Lessons for India

Fuel taxes are the only instrument through which any charge is made for road use in many countries. There is no unique retail fuel price appropriate to all countries and circumstances. But it is possible to underline the principles on which price should be established, to identify the components to be included in constructing the price, and to use international experience to suggest the broad orders of magnitude that this price formulation process will generate.

Options for incentive mechanism for clean fuels

Petroleum fuels currently sold in India have less stringent specifications compared to those sold in other parts of the world. For example, the sulphur content in diesel here is higher than that in the diesel sold in the developed world. Some recent developments have seen a tightening of the fuel quality standards, particularly for Delhi, Mumbai, Chennai and Kolkata. However, other cities in the country are yet to follow suit and policy directions would be necessary if the same standards as those applicable to Delhi are also to apply to other urban centres.

The cost of fuels in case the entire country moves towards cleaner fuels is very high, about Rs.350 billion for moving to Bharat Stage III. This cost can be considerably brought down in case there is no enforcement of a single fuel quality in the entire country. There can be differential quality of fuels in different regions like rural and urban areas, transport and non-transport applications etc. The areas where ambient air quality is an issue to be addressed are the places where the proposed fuel standards improvements have to take place.

The Hydrocarbon Vision 2025 points out the need for providing incentives for environment friendly fuels, through lower rates of duties. The duty structure of all petroleum products needs review and not just the currently controlled products. Any tax structure, which promotes adulteration, should be corrected. There are 3 ways in which cleaner fuels can be introduced.

Mandating Fuel / Emission standards.

This has been done for introducing Bharat Stage II quality of MS / HSD in Delhi and Mumbai where the price of fuel was raised to meet the additional cost of production of these fuels. In the above case, the tax structure of the fuel will remain same as that of the "BIS 2000" existing fuel and there would be no change in the revenue of the government.

There is a price premium paid by the consumer on Bharat Stage II grade fuel and it is currently on an average fixed at Rs.0.4 / liter for Delhi and Mumbai. However, the actual cost of producing this fuel will be different for different refineries, depending upon their complexity and capacity. In the case of MS, the additional premium for Bharat Stage II MS being sold in NCR region and Mumbai by the oil companies is passed on to the consumer.

With the dismantling of APM and oil companies free to fix prices based on market forces, the cleaner fuel can have a similar tax structure as the structure for the current fuel. Depending upon the demand of these fuels and competition that would prevail between various companies, these products would be priced in such a way that the premium on these fuels is either passed on to the consumer or absorbed by the oil marketing company. This policy would have the least impact on the revenues of the government, if any, because the companies would adjust final consumer prices of various categories of fuels keeping in view the respective demand elasticities. A point to be noted in this regard is that the choice of the vehicle technology would automatically direct the choice of the fuel. This would require that the corresponding standard of fuel is available and that there is cohesion between the movement of vehicle and fuel technologies. To illustrate this point further, a Bharat Stage III vehicle can use only an EURO III fuel. The choice of the fuel could then be directed by influencing the choice of the vehicle. Hence influencing the choice of the vehicle is an easier method of making changes in the fuel use.

Mandating Fuel standards along with capital incentives to manufacturers.

In this case, the government will give incentives for capital investments that would be made by the oil companies for producing the cleaner fuel. The up-gradation of refineries is capital intensive and any concession given to the refineries or the consumer would help in promoting the cleaner fuel by reducing the overall investments and also lower costs to the consumer.

The capital investment includes the cost of plant and machinery. This can be reduced considerably by giving import duty waiver on the additional de-sulphurization capacity and refinery up-gradation required. This would only be an extension of the existing benefit for green-field refinery projects. Another option is to provide for accelerated depreciation. Both the instruments can be used together. With many countries moving towards these cleaner fuels, it would be appropriate for our country also to move towards these technologies. India already exports surplus diesel / gasoline and the exports of these fuels from our country can be sustained only when the quality of these fuels keeps pace with the changing quality worldwide. Such measures introduced on capital investment will reduce the quantum of investments that refineries will have to make to up-grade their facilities. In order to ensure that these up-gradation projects are implemented in quick time, the exemptions that are provided can be graded across time with higher incentives being available if investments are made earlier.

The refineries whose cost of up-gradation is minimum should be targeted first. The North-eastern refineries in view of their low complexity and smaller capacities would require higher investments and also incur higher operating costs to produce cleaner fuels, but not contribute to a great extent to the amount production of these products. In this context a waiver to produce these fuels in these refineries would reduce the overall investment required to upgrade refineries and thereby reduce the cost of production of these grades of fuels to the consumer. Also in this case the issue of enforcement of single fuel quality in the entire country should be reconsidered. The products from the refineries, which do not upgrade can target the non-urban and rural areas for selling their products, thereby not affecting their product offtakes.

Taxation to influence Fuel Price

The current tax structure does not consider all fuels having similar tailpipe emissions at par for comparison, namely, CNG, Bharat Stage III fuels, LPG etc. The tax structure for different grades of fuels, as internationally observed, can be used to influence the choice of fuel and hence can be used as an effective instrument for encouraging changes in the fuel use. By making taxes reflect the environmental impact of fuels, consumers can be induced to choose the most environmental friendly fuel.

This current skewed tax policy of various Auto Fuels needs review in this context.

Issues Related to taxation of fuels

The 5 fuels as listed in the Auto Fuel Policy, which should be compared on the same platform, are given below:

- Bharat Stage II / III HSD
- Bharat Stage II / III MS
- CNG
- LPG
- Alternate non-fossil fuels like Ethanol, Bio-diesel.

Methods of fuel taxation

All fuels listed above are considered to be clean fuels and there should be market driven forces, which should determine the fuels of choice. The choice of fuel should not be distorted by way of taxes leading to the use of only a single fuel. The best example to illustrate this is the low level of excise on CNG and very high levels of excise on HSD / MS.

Internationally fuels as in Hongkong, New Zealand are compared based on their energy contents. Imported natural gas is based on its energy content. If auto-fuels are taxed based on their energy content, the choice would automatically be driven to the most energy efficient fuel for a particular mode of transport. For this to be implemented, the energy contents in each of the fuels need to be standardized (like in California). The ad-valorem rates can be based on the value per MMBTU or any other related energy unit. In addition to this, the fuel demand elasticity should also be taken note of to ensure that demand of these fuels is not skewed towards a particular fuel.

Eliminating distortions in duties

A wide disparity of the kind that exists today for excise duty between CNG and petrol / diesel of the kind what exists today would result in a distorted consumption pattern. Also, the lower duty on CNG gives it a distinct advantage over the other cleaner fuels in terms of price to the consumer. Basic prices of all fuels on par based on the energy content would require raising of natural gas prices to 115 % of the fuel oil parity. However, as a first step this could at least be raised to 100 % fuel oil parity as per the announced policy of the Government

In addition, increased penetration of CNG in metros would actually reduce the revenues of the government going by the current tax structure on natural Gas. In this regard availability of CNG is also to be considered as a limitation currently until the gas from imports is also available through the LNG import route for which infrastructure is being developed.

The duty for LPG should be similar to CNG as in terms of environmental impact they are similar fuels. Nevertheless, the viability of LPG as a transport fuel in terms of its availability, logistics of supply and safety issues need to be addressed before suggesting any duty exemptions on the use of LPG in the transport sector.

Parallel Marketing of different grades

As a principle, the fuels used in public transport modes can be taxed at rates lower than the tax on fuels on other modes of transport. However this has to contend with the possible diversion of fuel due to differential prices. There can be some head start made on this front by having 2 different tax structures on diesel for the Railways and STUs and the other diesel consumption. Also Railways can get a different quality diesel (BIS 2000 quality itself) as ambient air quality is not an issue except for metros. This is based on the principle that the entire country need not move towards a single fuel quality. It is possible to implement such a tax structure as Railways have separate distribution infrastructure and since they are a public transport mode there can be some duty relief given. The cost of the duty relief on this small quantity of diesel consumed can be distributed to the remaining quantity of diesel. (Railways consume 1.4 MMTPA of diesel compared with approximately 40 MMTPA of diesel consumed totally per annum.) Also since Railways is the most energy efficient public transport mode, it is imperative that Railways get the fuel at a cheaper price. This will help in the long term of goal of increasing the overall efficiency of public transport in terms of cost per passenger km or tonne km and also increasing the competitive advantage of the Railways.

Specific versus ad-valorem excise duty

The 2 ways, by which excise duty can be levied, are

- Specific Excise Duty
- Ad-Valorem duty

Specific excise duties can be levied which have the perceived advantage of being revenue neutral during the times of low oil prices and not affecting the consumer during the time of high oil prices. In case the specific excise duty method is used, the cleaner fuel can be levied a lower excise duty to the extent of the cost of production of cleaner fuel.

Specific duties are not in tune with a progressive tax structure towards which our tax structure is moving.

For the purposes of this study ad-valorem duties are only considered. The same magnitude of changes can be brought about even if specific excise duties are levied.

Value added tax (VAT)

Local taxes in addition to central taxes can create distortion in fuel prices. After rationalisation has been done on the customs and excise duty front, if states move to the VAT system then these taxes would be uniform across states. The state level taxes (VAT or current sales tax) should also be fixed on a similar basis as the excise duty is fixed. There is a wide range of state level sales tax starting with 0 % (in some North-Eastern states) and to even 34 % (including surcharge in Maharashtra) for HSD.

Proposed Pricing structure for alternate fuels

Having differential taxation can influence the prices between fuels thereby influencing their choice.

Higher duty protection to encourage indigenous up-gradation

The duty protection given to protect the margins of the domestic refineries will have to be continued and is not a feasible idea for change. The average import tariff rates could be brought down to the levels of 5 % for crude and 15 % for the MS / HSD (proposed post APM levels of tariff) but the differential of 10 % will have to exist to provide for margin protection of domestic refineries. This protection is proposed so that domestic refineries get a minimum margin after paying customs duty on imported crude.

To provide incentives to refiners for ensuring fast transition towards cleaner fuels, additional margin can be provided to the refineries by adjusting the customs duty structure. Thus, it is recommended that the BIS 2000 fuel (including diesel for Railways) to have 20 % BCD (Basic Customs Duty) (same as current level), Bharat Stage II with 25 % and Bharat Stage III by 25 %.

This will allow those refiners whose margins without the customs duty protection are lower than the competitors and this additional duty protection would help them in up-grading their technologies and compete with imports

It is also to be noted that the differential customs duty is to be applied only if the differential excise duty structure will also be applied, otherwise the price of the cleaner fuel would become costlier than the lower quality fuel.

This incentive should be made time bound to ensure that the up-gradation is fast and the incentive is to be removed after the specified time frame.

The import duty of LNG, which was reduced to 5 % by abolishing the counter-vailing duty of 16 %, should be continued as higher customs duty would render the use of LNG for power and fertilizer sector economically unviable.

Changes in Tax Structure

Changes in the tax structure for fuels of the same type meeting different norms are proposed with the underlying principle that the entire country need not move towards the same clean fuel norms. The targeted places for bringing in clean fuels being cities with a certain minimum population of both people and vehicles and those places which are identified as hot spots in terms of ambient air quality deterioration.

The main tax components in the pricing of petroleum products are:

- Excise Duty
- Central Sales Tax
- State Sales tax

The environmental ranking of fuels (MS / HSD) are given below:

1. EURO IV
2. Bharat Stage III
3. Bharat Stage II
4. Bharat 2000 (BIS 2000)

Central Sales Tax

These taxes will not affect the prices, as they are the same for all fuels. The Central Sales tax would be abolished with the transition to VAT by the states.

State Sales Tax

The sales tax from petroleum products is one of the main sources of revenue for many states. Any suggestion to reduce these rates would be met with lot of resistance. When states move to the VAT system of taxation, a uniform level of taxation across states can be the direction in which movement can be made. Changes need to be introduced in the application of these taxes also. Currently the tax is applied not only on the basic price but on the basic price plus the duty. This increases the final price to a great extent taking the total tax on petrol to about 120 % of the basic price in few states.

The variation of sales tax for MS and HSD in some states are shown in the table below·

Table 4.6. Sales tax

State	MS % tax	HSD % tax
Delhi	20	12
Maharashtra	27	30
Andhra Pradesh	30.55	19 33
Assam	20	12
Punjab	20	8

The states can also play their part in promoting the environmentally friendly fuels by having lower sales tax rates for cleaner fuels when compared to the higher levels for less clean fuels.

Excise Duty

This is the only other component, which can be easily changed as it is under the direct purview of the Central Government. Thus, the excise duty is used as the main instrument for effecting changes in fuel pricing and is analyzed in detail in this section. The excise duty is the only part of the price build-up, which can influence the price of the fuel effectively.

The basis of arriving at excise duties is the environmental ranking of the fuels with the Railways being the exception.

The incremental cost of producing these fuels would be different for different refineries, the table below gives the minimum and the maximum costs of producing Bharat Stage II and Bharat Stage III MS and HSD.

Table 4.7. Relative Costs of Producing Bharat Stage II and Bharat Stage III fuels(11)

Product	Minimum Rs/l	Maximum, Rs/l	Maximum Excluding NE refineries Rs/l
MS			
BIS 2000 to Bharat Stage II	0.00	2.80	2.8
BIS 2000 to Bharat Stage III	0 60	13.00	5 7
HSD			
BIS 2000 to Bharat Stage II	0.25	3 05	1.6
BIS 2000 to Bharat Stage III	0 90	4 3	2 5

It is to be noted that these costs are not split into the fixed and variable costs After providing some incentives on the capital investment being made, there would be a reduction in these costs, which are not taken into account in these costs of production.

It is observed the more complex refineries could produce these better grades than the less complex refineries. The low capacity, less complex North-Eastern refineries would incur a very high cost to produce these clean fuels, hence their costs are not considered for arriving at the proposed duties. BPCL-Mumbai, IOC-Mathura, IOC-Panipat, RPL-Jamnagar, HPCL-Mumbai and Vizag are some of the main refineries considered for supply of these fuels.

It is proposed that Railways diesel is taxed lower than the BIS 2000 as it is a very important factor in the overall perspective of higher efficiency in public transport. The excise duty for the highest environmentally ranked fuel should be the lowest and that of the lowest should be the highest. The proposed Excise duties on the various grades of diesel are given below based on the excise rate, which would make the all grades of fuel equally priced. Also since excise duties have been rationalized, the proposed rates are moved to closest multiple of 8 %

Table 4.8. Proposed Excise duty for various grades of diesel

diesel Grade	Excise Duty, %
diesel for Railways	24
Bharat Stage III	24
Bharat Stage II	24
BIS 2000	32

As an illustration, the price of diesel at Mumbai for these duties is given in the table below As already pointed out earlier, in the post APM period oil companies will be free to fix the prices of these fuels. With the diesel for Railways also being priced at lower levels, any inflationary trends due to higher diesel price could also be checked.

Table 4.9. Projected Relative Prices of various grades of diesel

Grade	Price, Rs/l
BIS 2000	21.9
Bharat Stage II	21 9
Bharat Stage III	21 9
Railways	20 7

These are illustrative price impacts, but in reality companies would price fuels differently and could charge higher prices for cleaner fuels.

In case of MS also a similar exercise of fixing the duty at which the prices of all grades of MS equally was done. For an illustration the premium from BIS 2000 to Bharat Stage II is Rs.0.85/l and that of Bharat Stage III from BIS 2000 is Rs.2.85/l [a], these values being the median of the cost of production of these grades of MS in refineries excluding the North-Eastern refineries. The price build-up of MS and HSD with the differential duties is given in Annexures 4.2 and 4.3.

Table 4.10. Proposed Excise duties on various grades of MS and Price Impact

MS Grades	Excise Duty %	Price, Rs/l
BIS 2000	32	28.8
Bharat Stage II	24	28.8
Bharat Stage III	8	28.8

In both cases when in 2007 BIS 2000 quality will cease to exist, Bharat Stage II will become the base quality and the cleaner norm would be Bharat Stage III. So, Bharat Stage II diesel would attract the higher tax rate.

The incentives given should be phased out as and when the fuel quality becomes mandatory.

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[a] In the General Budget 2002-03, Rs.6/l surcharge per liter of MS has been imposed in addition to the excise duty of 32 %. This is also considered in the above price build-up.

CNG would be equivalent to Bharat Stage III MS in terms of emissions. (Along with the corresponding vehicle technology) The excise duty for CNG can be made equivalent to that of Bharat Stage III MS on an energy equivalent basis.

CNG is equivalent to 1.15 times MS in terms of its volumetric energy content. Currently the excise duty for CNG in Mumbai is Rs.1.23 /kg. To match the excise duty with Bharat Stage III MS, the proposed excise duty level for CNG is 8 %. But it is also to be noted that this duty should be based on complete thermal parity with fuel oil. This can be made applicable only for the natural gas that is used by the transport sector alone to ensure that the economics of other sectors are not affected. The price build-up of CNG is illustrated in Annexure 4.4.

Table 4.11. CNG Proposed Duties

	Current Excise Duty, %	Proposed, %
CNG	8	8

The duties proposed give the direction in which the differential duties can be designed to promote easy penetration of clean fuels. The same differential between the various grades of fuel can still be maintained, irrespective of whatever the base level of excise duty on MS and HSD are fixed at.

The proposed increased customs and excise duties for less clean fuels and corresponding lower levels of duties for cleaner fuels would not result in any loss to the government. These tax structures would help in refineries optimize their overall product slates to maximize their margins. To illustrate this point, BPCL could produce clean fuels from its Mumbai refinery and produce "BIS 2000" fuels from its Kochi refinery and overall it would cover the cost of producing cleaner fuels. The benefits of the differential pricing systems of various grades of the same product can be accrued to the Oil Company based on its optimization of its overall product slate.

There would be disparity of prices of fuels between various locations as the oil market would be free with competition between various companies. It is also to be noted that differential prices of fuels in different places could lead to adulteration of the BIS 2000 costlier fuel with the cheaper cleaner fuel. Strict enforcement of highway vehicles not being allowed into city limits is to be ensured to ensure that the benefits reach the targeted population of people who ply within the city limits.

Renewable Fuels

Renewable bio-fuels like ethanol, bio-diesel would not be competitive if they are treated on par in terms of taxation with the fossil fuels. To increase their share in the total fuel consumed they would require total excise exemptions. Without these exemptions, their use would not work out to be economically viable. With a production cost in the range of about Rs.18-19 per liter, with the rates of excise that are currently being imposed on petrol, ethanol would not be competitive at all. Providing for excise exemption would increase the use of ethanol. Almost all developed countries have introduced exemptions for promoting the use of ethanol. Similar exemptions would be required for bio-diesel to make it competitive in the market.

These exemptions should be given only till this industry develops in terms of capacity and reducing cost of production of ethanol by up-grading the technologies. A proper time frame should be fixed for the ethanol industry for deriving benefits from these exemptions.

The promotion of ethanol to the extent of blending 10 % in MS is essential and has the following benefits. The countries, which have had ethanol promotion programmes, have experienced most of these benefits.

- Reducing trade deficit as it would reduce crude imports by about 20 times of the extent of ethanol that is blended to MS. In case 10 % is blended to MS and an average MS yield of 6 % per refinery, this comes to about 10 MMTPA based on the total MS demand per annum at 6 MMTPA. (The country is actually surplus in MS with the surplus being exported currently, this quantity will increase if ethanol to the extent of 10 % in MS is made mandatory along with the excise exemption being given for ethanol.)
- Increasing capacity utilization of the distilleries, which have spare capacity.
- Help in achieving the long-term objectives of reducing green house gases since ethanol considerably reduces CO_2 emissions over the entire life cycle starting from the farm to production of ethanol.
- In providing energy security to the country in terms of increasing share of indigenous sources of energy.

Similar total excise exemptions would be required for bio-diesel also since this is a renewable fuel and has many environmental benefits as already pointed out by the Auto Fuel Policy Interim report.

Ranking of various proposals

The various recommendations made are ranked based on their applicability in the post APM scenario and the ease with which the instruments can be applied for greater transparency.

- Differential Excise Duty is the instrument that would give maximum benefit to the consumer and easy in terms of implementation.
- Encouraging domestic refineries to up-grade their facilities in a specified time frame by giving a higher duty protection in order to compete with the imports.

Summary of recommendations made

To summarize, the following are the recommendations of tax and duty structure for various alternate fuels.

- To reduce overall cost of investments for refineries for product up-gradation, customs duty waive off for a specified time frame much before the mandated deadlines for various fuel quality standards should be provided. This will reduce the investments to a great extent and thereby contribute in reducing the overall cost of producing various cleaner fuels.
- Accelerated depreciation also can be provided across the same specified time frame to the refineries, which up-grade their facilities.

The various instruments available to influence the price of the fuels are ranked in the order of implementation.

- Differential excise duties for fuels of the same type meeting different standards to price the highest environmentally ranked fuel at the lowest level.
- Tax the diesel consumed by the Railways and STUs at a lower level than the road diesel in the long-term interest of making public transport cheaper and more efficient.
- States should be prevailed upon in giving exemptions for promoting environmentally fuels would further help in promoting these fuels and should not negate the benefits of lower excise duties.
- To enable domestic refineries whose margins are low when compared to their peers to up-grade their facilities to provide clean fuels by providing for additional duty protection and compete with imports.
- The differential tax structure and exemptions proposed for the cleaner fuels should be phased out as and when they become mandatory.
- Tax all fuels having similar environmental impact at the same level on an energy equivalent basis. This includes alternate fossil fuels like CNG, LPG.

- These proposals can be implemented from April 1st, 2002 for the 4 metropolitan cities which are at Bharat Stage II level of fuel quality to enable moving quickly to Bharat Stage III quality.
- To make the renewable fuels like ethanol and bio-diesel competitive, they have to be totally exempt from excise to start with. This will facilitate their increase in market share. This incentive can be slowly phased out when the industry becomes competitive.
- With the subsidy on Kerosene / LPG being phased out in the next 3 to 5 years, the taxes collected from transport fuels should be fully dedicated to transport infrastructure development as is being done in developed countries.

Annexure 4.1 - Country-wise Experience

US

Fuel taxation in the US (5,6) is largely used to raise revenue for a range of specific objectives, mostly road funding both at federal and state levels. Some states provide subsidies in addition to the federal subsidy on ethanol use. In addition to these exemptions, concessions are also provided for LPG and CNG from domestic sources. The stated reasons for these concessions are intended to decrease the United States' dependence on imported fuel, increase energy security through the use of domestically produced alternative fuels, reduce the balance of payments deficit and stimulate domestic employment.

The United States federal government and some state governments also seek to influence levels and forms of energy consumption through mandatory targets for use of low emission vehicles. Transition to these targets is assisted by tax credits, deductions, and exemptions for purchase of alternative fuels and alternative fuel vehicles in addition to the cost of building and maintaining alternative fuelling facilities.

In California the energy contents of all fuels are standardized. This helps in arriving at MS-equivalents or diesel- equivalents of fuels.

The standardized energy contents of important fuels are given below (in BTU/gallon): (3)

Gasoline : 115400
Diesel : 128700
CNG : 100000
Propane . 86650
Methanol 85 · 65675

The taxes of all fuels have been levied in such a way that they match with MS in terms of their energy content This way all fuels are treated on a similar platform in terms of their efficiency. This method also removes any distortion from the tax structure. (Gordon Schremp, California Energy Commission, Fuel Resources Office, October 1995)

The US EPA has mandated that 30 % of oxygenates in reformulated gasoline must be made from renewable sources of energy. The mandate if implemented would result in a larger aggregate subsidy for ethanol is taken into account. The mandate would stimulate the production of ethanol, increase ethanol's fraction of the future oxygenates market but also increasing revenue losses from the existing tax incentives. But these incentives are being continued in the overall interests of energy security for the future.

Of all the existing tax incentives, the 5 4-cent per gallon exemption from the motor fuels excise taxes has been the most effective in stimulating alcohol fuels development. It is also observed by the US Congress that tax incentives are a more efficient way to stimulate alcohol fuels development than having only mandates to increase the share of alcohol in the fuel consumed.

European Union (EU)

Fuel taxes are described by the members of the European Union (2) as environmental taxes, though they also serve to raise general revenue. All members apply value-added taxes (VAT) to fuel, though a small number of members apply lower rates to gas and electricity. In addition to the full rate of VAT, transport fuels are taxed at rates, which lead to taxation being over half up to three-quarters of the final cost of petrol and diesel.

Three types of taxes are applied to all forms of energy in the EU:

- Value added tax proportional to the selling price.
- Excise duties proportional to the physical quantity of the product, and
- Specific taxes and duties.

An EU directive requires that all energy products, except natural gas, should be subject to a standard minimum VAT of 15 %. Lower rates for electricity and transitional rates complicate the picture, and applied rates for electricity vary from 5 % (UK, Portugal) to 25 % (Denmark, Finland and Sweden). Natural gas is usually taxed at the standard VAT rate though it receives significant concessions in the UK, Greece and Luxembourg. Public transport receives concessional VAT rates in all members.

EU has also noted that a disparity in the treatment of different energy forms leads to distortions. Most countries maintain lower excise duties for diesel, atleast partly to support their road transport industries. Excise and vehicle taxation differentials are used widely to encourage adoption of more environmentally favourable fuels. For example, The Netherlands provides for vehicles tax cuts from July 2001 of euros 325 and 720 for petrol and diesel vehicles, which meet the 2005 norm respectively. Germany has an excise differential for petrol and diesel with less than 50 ppm Sulphur, and is planning a further differential to favour fuels with less than 10 ppm Sulphur from 2003. Such differentials are also in place in Sweden, Finland, Denmark, Norway and Belgium.

A general observation across member states is that domestic and transport use of fuels is more heavily taxed than industrial use. Another general observation is that mineral oils for automotive use are more heavily taxed than fuels for other uses.

United Kingdom (UK)

In UK (2,8) the general VAT of 17.5 % is applied to transport fuels, but petroleum fuels and coal and gas for domestic heating are taxed concessionally at 5 %. VAT on fuels for industry is refunded. The UK rates of fuel excise are the highest among the OECD countries (IEA Energy Prices and Taxation, Third Quarter 2000). Taxes were as high as 78 % of the final price of petrol and automotive diesel in March 2001.

In 1993, a major change in petrol taxation came under the Conservatives with the introduction of the fuel price escalator. This was designed as a means both to raise money and discourage car use on environmental grounds. The annual fuel escalator was set in 1993 at 3 % above the rate of inflation. On its introduction it added 3 pence per liter to the cost of the fuel and raised a tax burden on unleaded petrol to 72.8 % of the total cost. In 1997, this was at 5 % and contributed 11.1. Pence per liter rise to the cost of the unleaded fuel. Tax as a proportion of the total cost stood at 76.3 %. This was further increased by another 3 pence per liter and after this increase the total taxes went up to 81.5 % of the total price of the fuel.

There is a campaign, which argues that VAT should be calculated only on the cost of the fuel rather than on the fuel and the duty together. This would save the motorist about 8 pence per liter at September 2000 price, though this argument has not found any takers among the political fraternity.

In UK, low sulphur petrol and diesel are taxed at the same rate unlike all the other EU members, as there is no policy of discriminating between fuel types of comparable environmental impact. Diesel has greenhouse gas advantages and petrol has air quality advantages (lower particulates). The UK has, however actively fostered cleaner burning, low sulphur variants of fuel. It introduced a duty differential for ultra low sulphur diesel (ULSD) which rose to 3 pence per liter from 1997 to 1999. This led oil companies to produce and supply ULSD and an almost complete conversion of the diesel market in just 2 years. UK refineries process crude oil which is naturally low in sulphur but would still require additional refining to meet the levels of less than 50 ppm sulphur and reduction of benzene based chemicals. The duty differential which was fixed at 1 pence per liter to start did not encourage all refineries to change their production to these cleaner grade of fuel as they felt that this differential did not cover the cost. The general impression was that the incentive was not enough to change the grade of diesel they produced much before the mandated time frame of 2005. The change happened dramatically when the duty differential was raised from 1 to 2 pence per liter. Just 2 years after the introduction of the duty differential and 6 years before the mandated time frame for implementation of this grade of diesel, this product had increased its market share to 100 %. This effect was more rapid and complete than the switch from leaded to unleaded petrol, as no change was required to existing engines. The introduction of an excise differential between standard and low sulphur petrol of one pence per liter in late 2000 saw the low sulphur variant increase its share of total petrol market from 42 to 93 % from mid-November 2000 to 31 March 2001.

Rebates are provided on fuel tax and vehicle excise duty for farmers and other off-road users. The rebated fuel is dyed to make detection of diversion easier. Rebates are also provided to alternate fuels with *bio-diesel receiving a 20 pence per liter advantage from 2002*. The UK already provides a differential excise rate for diesel-Water emulsion, LPG, natural gas and methane when used as fuel in motor vehicles.

Japan

Japan's rates of taxation for transport fuels fall in the middle range of taxes applied by OECD countries (2), but a number of local and national taxes also are levied on vehicles which makes the total cost of vehicle operation relatively expensive. Most of the fuel and vehicle taxes are dedicated to road construction which has been the major policy objective in recent decades. Import duties and a specific petroleum tax are also applied to imports of fuels. The petroleum tax was established in 1978 to fund policies such as oil stockpiling and also fund expenditure on alternative energy sources.

Kerosene, used for domestic heating and cooking, is taxed at concessional rates compared to near substitutes, such as diesel, used in transportation.

Hongkong Experience

Hongkong imposed a lower duty on unleaded petrol (7) prior to the banning of leaded petrol. This helped in phasing out leaded petrol. A lower duty rate was imposed on ultra low sulphur diesel to again ensure speedy change to this grade of diesel. Another measure that the government took was to reduce the price of land for setting up LPG filling stations in order to reduce the price of LPG.

There have been suggestions to base fuel duties on energy content of fuels. Also there is a waiver on duty for fuels used for public transport like franchised buses.

It was also observed that all the benefits given for promoting the cleaner diesel were not passed on to the consumer by the oil companies until there was intervention by the government. The oil marketing companies were found to be pocketing some part of the duty benefits without passing it on to the consumer.

Brazil Experience

The experience in Brazil (1) is very important and relevant to India as it is also a developing country like India with a predominantly agrarian economy. Brazil's "Proalcohol" programme, which started with the oil, shocks in early seventies met with astounding success.

The "Proalcohol" programme providing incentives for the production of fuel alcohol in Brazil has played an important role in diminishing the dependence of the country on oil imports. But during the last 25 years of implementation of this programme, oil prices had also decreased leaving surplus gasoline with the oil companies of the country and also encountering alcohol shortages in 1989 Nevertheless, the growth of the fuel alcohol industry in Brazil is only because of the incentives and thrust from the government for more energy security.

International level of taxes on fuels

The total percentage of taxation on Petrol/HSD in India and other countries of the retail price of the fuel is given in the table below: (the total includes customs duty protection, excise duty and SED, and state level sales tax)

Tax component of Retail Fuel Price

Country	Petrol % tax	diesel % tax
India	70	58
UK	80	71
US	32	35
Japan	55	42
Canada	48	34
Germany	76	59

* For Mumbai (approximate figure) including local state taxes.

Annex 4.1 a

MS and HSD Price build-up Mumbai

	Bharat Stage II HSD	Bharat Stage II MS
	Rs/l	
CIF Price @ Mumbai	9 039	9.377
Price including BCD*	10 8	11 72
Price inclusive of customs duty	10 8	11 7
Marketing Margin	0.4	0.4
State Surcharge Maharashtra	0 32	0.3
Price inclusive of Excise duty @ 32 %	15 2	23.0
Addl Excise Duty, flat rate	1.0	0.0
Subtotal Inc Excise	16.23	23.0
Retail pump Operating charges	0 08	0 08
Sales tax @ 34 %	5.5	6.2
Price including Sales Tax	21 9	29.3
Dealers Commission	0.3	0.3
Retail Selling Price Rs/l	22.2	29.6
% of tax	58%	67%

Annex 4.2

Equalized Prices by adjusting excise duties

Port Location Example Mumbai HSD

	BIS 2000 @	Bharat II	Bharat III	Railways
	Rs/l	Rs/l	Rs/l	Rs/l
CIF Price @ Mumbai	8.92	9.039	9 368	8.92
Price including BCD*	10.7	10.85	11.24	10 7
Price inclusive of customs duty	10.7	10 8	11 2	10 7
Marketing Margin	0 4	0.4	0 4	0.4
State Surcharge Maharashtra	0.32	0.32	0 32	0.32
Excise Duty	3.65	3.5	3.10	2 73
Price inclusive of Excise duty**	15.0	15.0	15.0	14 1
Addl Excise Duty, flat rate	1.0	1.0	1 0	1 0
Subtotal Inc Excise	16.04	16.0	16.0	15 1
Retail pump Operating charges	0.08	0.08	0.08	0 08
Sales tax @ 34 %	5.5	5.5	5.5	5.2
Price including Sales Tax	21.6	21.6	21.6	20 4
Dealers Commission	0.3	0.3	0.3	0.3
Retail Selling Price. Rs/l	21.9	21.9	21.9	20.7
Excise Duty Rate	32%	30%	26%	24%

@ is not applicable for Delhi/Kolkata/Chennai/Mumbai

Annex 4.3

Equalized Prices by adjusting excise duties

Port Location Example Mumbai MS

FOB Singapore being 28 $ / bbl for gasoline

	BIS 2000 @ Rs/l	Bharat II Rs/l	Bharat III Rs/l
CIF Price @ Mumbai	9.258	10.108	12.108
Price including BCD*	11.1	12.13	14.53
Price inclusive of customs duty	11.1	12.1	14 5
Marketing Margin	0.4	0.4	0.4
Excise Duty	3.70	2.68	0 3
*Price inclusive of Excise duty***	15.2	15.2	15 2
Addl Excise Duty, flat rate	6.0	6.0	6.0
Subtotal Inc Excise	21.2	21.2	21.2
Retail pump Operating charges	0.08	0.08	0.08
Sales tax @ 34 %	7.2	7.2	7.2
Price including Sales Tax	28.5	28.5	28.5
Dealers Commission	0.3	0.3	0.3
Retail Selling Price. Rs/l	28.8	28.8	28.8
Excise Duty Rate	32%	21%	2%

@ is not applicable for Delhi/Kolkata/Chennai/Mumbai

Annex 4.4

CNG Price Buildup illustration

	Excise on par with Bharat Stage III gasoline	
	CNG import thru LNG route	CNG indegenous
	Rs /kg	Rs /kg
CIF Price @ Mumbai	10.10	8.06
Price including Basic Customs duty @ 5 %	10.61	8.06
Cost of distribution	4.72	4.72
Price of Gas Sold to OMC	15.33	12.78
Excise Duty	1.23	2.04
Subtotal Inc Excise	16.55	14.82
Sales Tax @ 13 %	2.15	1.93
Surcharge @ 10 % of sales tax	0.22	0.19
Turnover Tax @ 1 % of basic price	0.15	0 13
Price inclusive of State taxes	19.07	17 07
Dealers Margin	1.20	1.20
Retail Price	20.27	18.27

CNG indigenous is based on 115 % thermal parity with fuel oil landed cost

CNG import is from middle east to west coast of India

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